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ABSTRACT

This document is a curriculum guide for instructors teaching vocational preparation for electrical wiring to special needs students. The purpose of the curriculum guide is to provide minimum skills for disadvantaged and handicapped students entering the mainstream; to supplement vocational skills of those students already in a regular training program (mainstream); and to provide vocational instructional materials for the modified classroom. Ten units of self-paced and self-contained instructional materials are contained within the electrical wiring curriculum. Units are illustrated and simplified to more easily aid a student in class activities or on an individual basis. The separate sections of each unit are color coded and consist of the following: objective and student assessment (presents the unit objectives and provides self-assessment statements for students); introduction (contains a brief motivational statement describing the theme of the unit); tools, materials, and equipment needed to complete the exercise; steps of the procedure, with illustrations; and student evaluation, to be used by the instructor. Topics covered in the 10 units include jobs related to electrical wiring, electrical wiring tools and their uses, wires and wiring materials, safety rules in electrical wiring, splicing electrical wires, soldering and taping electrical wire splices, installing a single-pole switch, installing series wiring, installing and wiring outlets in parallel, and installing cable in house framing. (KC)

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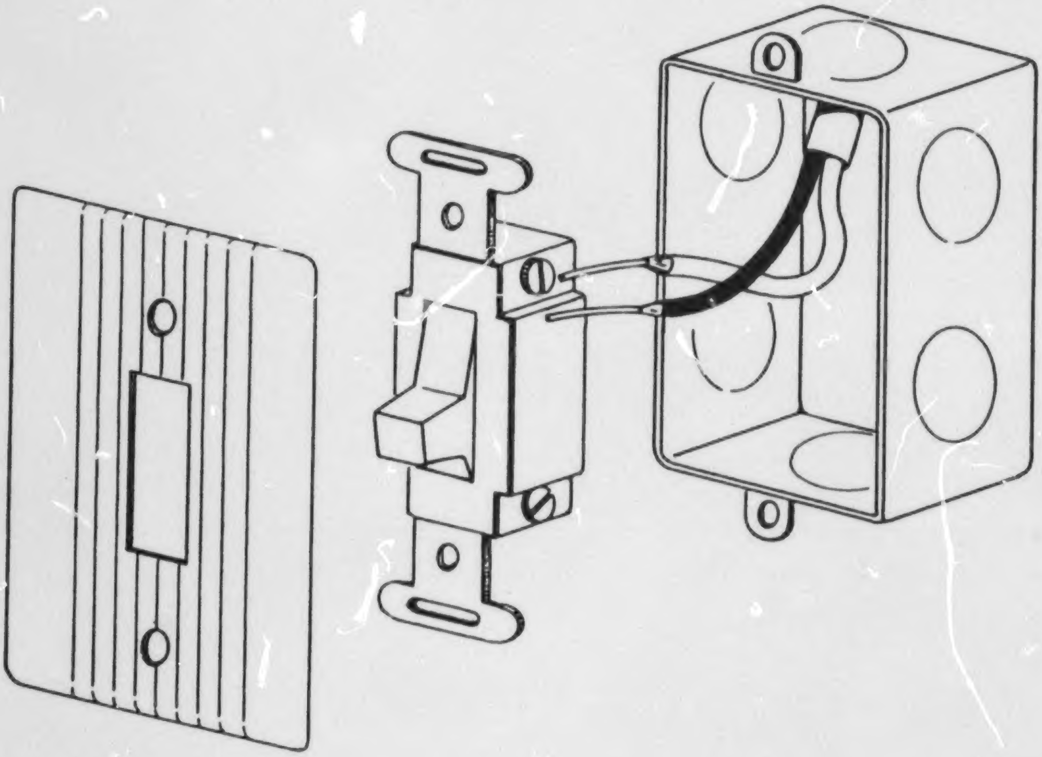
Vocational Preparation Curriculum



Electrical Wiring

Developed By: Hogan Usoro

CE 029 270

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
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Vocational Preparation Curriculum
ELECTRICAL WIRING

Preface

This Vocational Preparation Curriculum guide is a Special Needs project sponsored by the Missouri Department of Elementary and Secondary Education. The purpose of this curriculum guide is:

1. to provide minimum skills for disadvantaged and handicapped students entering the mainstream,
2. to supplement vocational skills of those students already in a regular training program (mainstream),
3. to provide vocational instructional materials for the modified classroom.

This guide is intended to be a workable guide for instructors serving the occupational needs of various categories of Special Needs students.

Ten units of self-paced and self-contained instructional materials are contained within this electrical wiring curriculum. Units are illustrated and simplified to more easily aid the student in class activities or on an individual basis.

Each unit is color coded to represent a separate section within the unit, the color coding is:

White: Objective and Student Assessment - Presents the unit objectives. The student must meet these objectives to successfully complete the unit. Self-assessment statements help the students to determine their ability to perform the unit objectives.

Goldenrod: Introduction - Contains a brief motivational statement describing the theme of the unit.

Salmon: Tools, Materials, and Equipment - Introduces new tools, materials, and equipment necessary to complete the exercise.

Canary: Steps of Procedure - Presents a step by step explanation and illustration of the skill to be learned.

Pink: Student Evaluation - Used by the instructor to evaluate student performance. Three different forms of evaluation are presented; true-false, identification, and Steps of Procedure Evaluation.

Material within this curriculum is developed to provide a source and guideline for the instructor. The responsibility of the instructor will be to adapt material as is necessary to suit a given teaching/learning situation. It is intended that this material will provide a basis for that adaptation.

Vocational Preparation Curriculum
ELECTRICAL WIRING

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Acknowledgments

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Committee Members:
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Steve Parker, Instructor, Rolla Area Vocational-Technical School
Jim Walker, Instructor, Cass County Area Vocational-Technical School, Harrisonville, MO
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Mr. Miles Beachboard, Director of Vocational Special Needs Programs, Department of Elementary and Secondary Education, Jefferson City, Missouri
Mr. Larry Lutz: Director, Camdenton Area Vocational-Technical School

Instructional Materials Laboratory, University of Missouri-Columbia
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A special thanks goes to all the other individuals who made contributions toward the completion of this project.

Notes to the Instructor

Step 1 Read through the information in this unit before presenting it to the student.

Step 2 Make sure all tools and materials to be used in this unit are available.

Step 3 Prepare any handouts, if applicable, to aid student learning activities.

Step 4 Provide the student with self-assessment (objective) sheet.

Step 5 Discuss tasks on self-assessment sheet and give directions for completing the Show What You Can Do section.

Step 6 Have student complete self-assessment sheet.

Step 7 If the student elects to take the Practical Exercise and completes it to the satisfaction of the instructor, have the student proceed to the next package. If the student fails to complete the Practical Exercise to your satisfaction or does not wish to take the exercise, proceed to Step 8.

Step 8 Provide and discuss the Introduction sheet with the student. At this time you can also discuss the Tool, Materials and Equipment list.

Step 9 Provide the student with Steps of Procedure.

Step 10 Present the Steps of Procedure. Depending on the capabilities of the student, select one or more of the following means of presentation:

a. have student study information independently,

or

b. go through the Steps of Procedure with the student individually or as a group.

Step 11 Instructor can demonstrate the procedures to the student or the group.

Step 12 Allow the student time to practice the procedure.

Step 13 When the student feels ready, use the Practical Exercise Checklist to evaluate the student's performance capabilities.

Additional Suggestions for the Instructor

Try team approach when possible.

Beginning students can work together after instructor's demonstration.

One student experienced with the procedures can work with a beginner.

For non-readers, audiotapes or videotapes of the lesson could be prepared.

Review tools and materials with the students whenever necessary. Tools and Materials Identification Exercises are provided in some units for instructors' use.

Tools and Materials Identification Exercises can be used in the following suggested way:

As a pencil and paper exercise

Actual Tool/Material Identification: Instructor holds up or points to an actual tool or material for the student to identify, or the instructor names a particular tool or material and asks the student to locate it.

Name-Object Association: Instructor prepares cards with names of tools and materials. The student matches the name card with correct object.

Additional modifications of above suggestions can be effected by the instructor to take care of other special needs conditions.

Plan visits to local electrical shops.

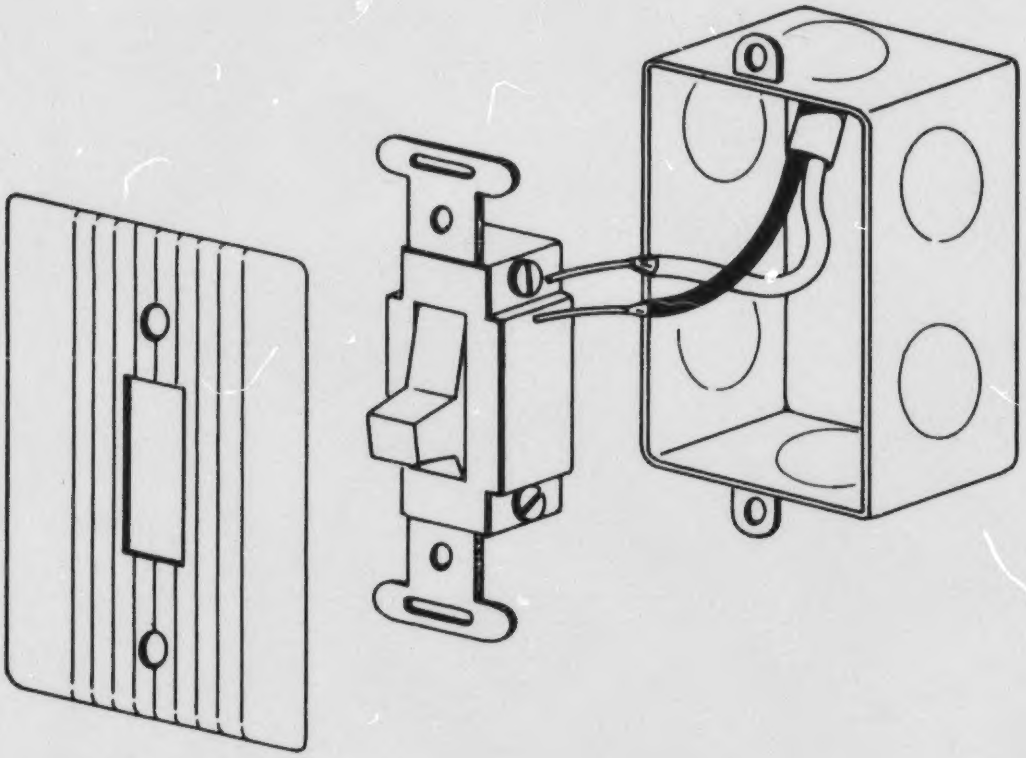
Vocational Preparation Curriculum
ELECTRICAL WIRING

Class Progress Chart

Student's Name

											WHAT THE STUDENT CAN DO
											Identify Wiring Tools and Their Uses
											Identify Wires and Wiring Materials
											Identify Safety Rules in Electrical Wiring
											Splice Electrical Wires
											Solder and Tape Electrical Wire Splices
											Install a Single-Pole Switch
											Install Series Wiring
											Installing and Wiring Outlets in Parallel
											Instructor's Signature Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 1

Jobs Related to Electrical Wiring

Developed by: Hogan Usoro

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Unit 1

Jobs Related to Electrical Wiring

Jobs Related to Electrical Wiring

After you study this lesson, you should be able to:

1. Name and locate electrical wiring jobs in your city or area.
2. Select an electrical wiring occupation and give a reason for your choice.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

SEE YOUR INSTRUCTOR

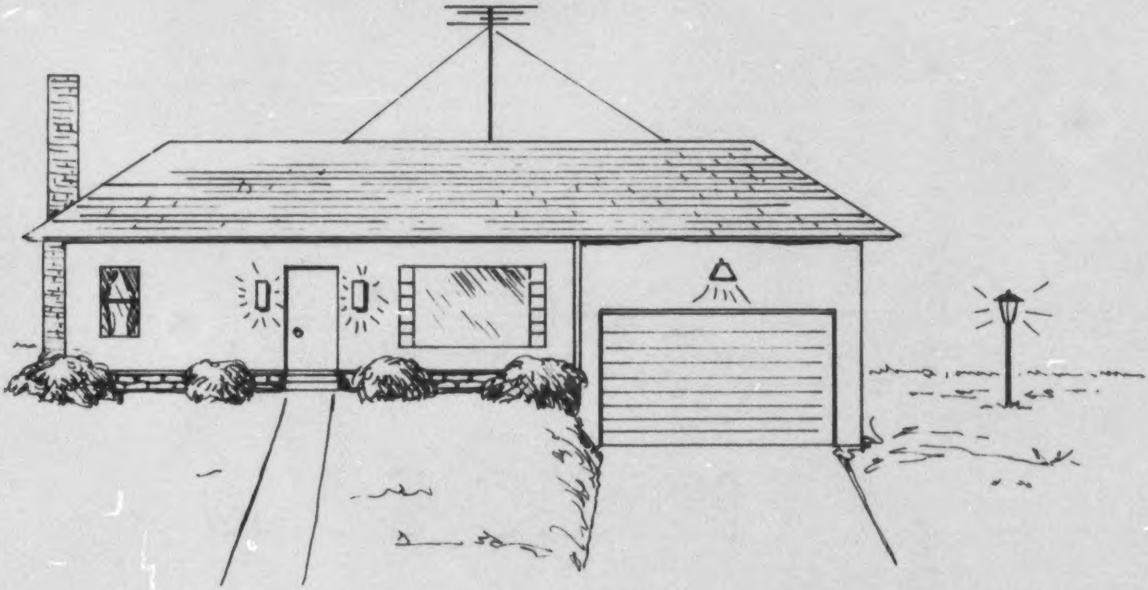
2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

TURN THE PAGE AND BEGIN

Unit 1
Jobs Related to Electrical Wiring

Introduction

Electrical wiring is a very important part of home building. Heat, lights, radios, air-conditioning and refrigerators are all controlled by electricity. Electrical workers are responsible for seeing that these appliances work properly. They also are responsible for making sure the house is properly wired to accept these items.



Residential wiring is done in a house to operate lights, heat and appliances. There are many other types of wiring jobs found in electrical wiring occupations. You will learn about some of them in this unit.

TURN TO NEXT PAGE

Unit 1
Jobs Related to Electrical Wiring

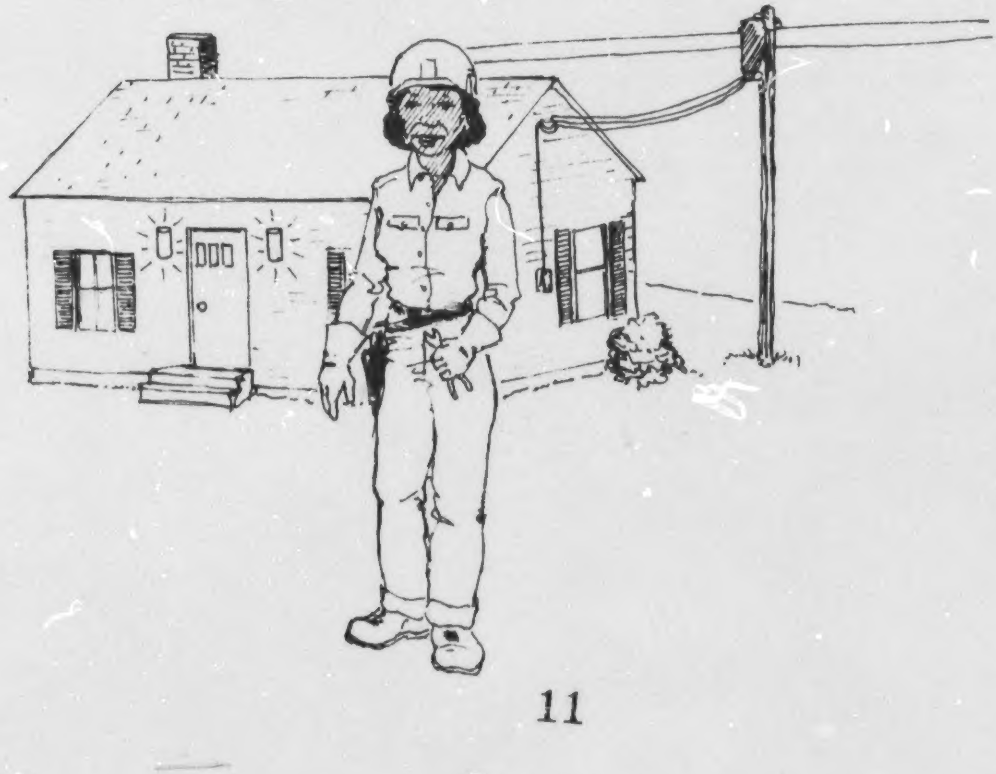
A. Job Opportunities in Electrical Wiring.

Persons who have knowledge of and skill in electrical wiring can work in a variety of electrical jobs. Your training will provide basic knowledge about electrical wiring. You will be able to apply that knowledge in the following electrical wiring areas:

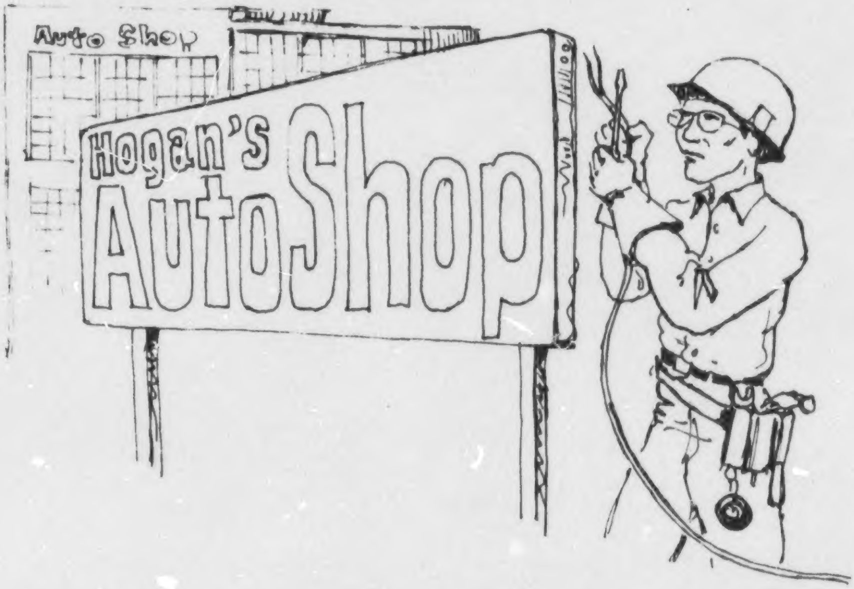
1. **RESIDENTIAL WIRING:** Basic house wiring, which includes:

   Installing cable for lights and appliances in houses.

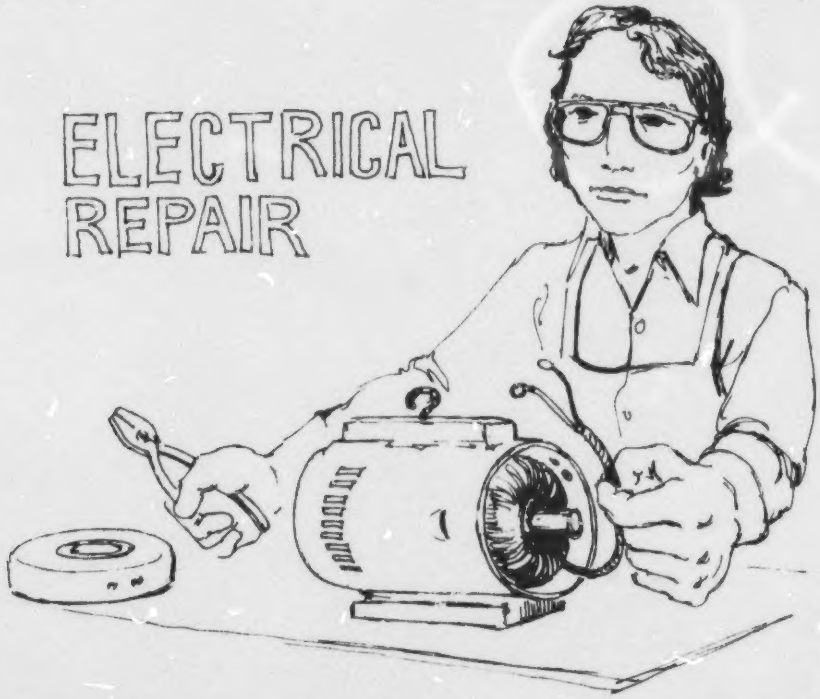
   Installing the service entrance which connects electricity from the utility pole to the house.



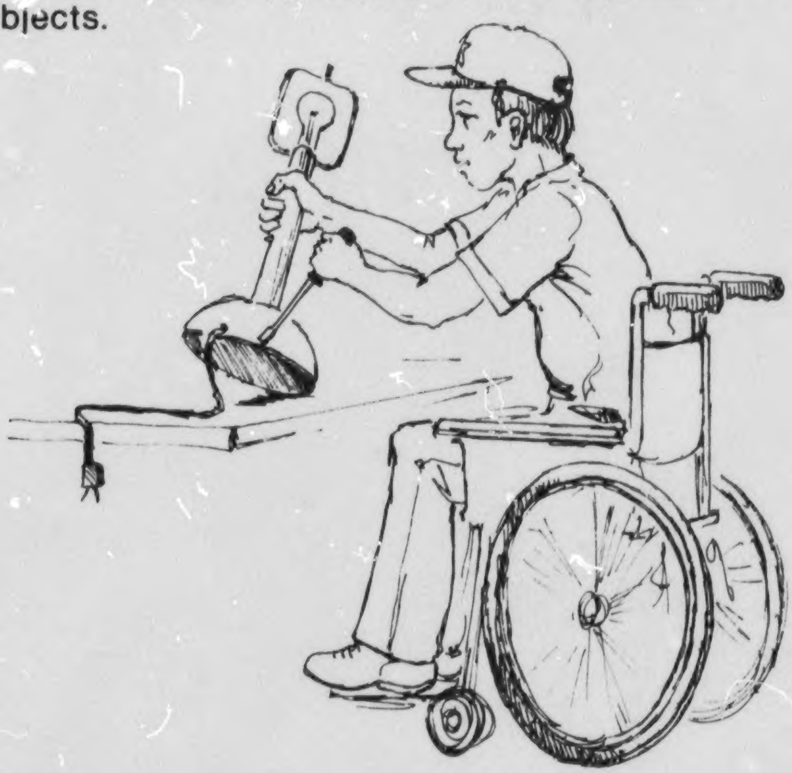
2. **COMMERCIAL WIRING:** This involves wiring commercial buildings like banks, factories, hospitals and public places.


Auto Shop
Hogan's
AutoShop

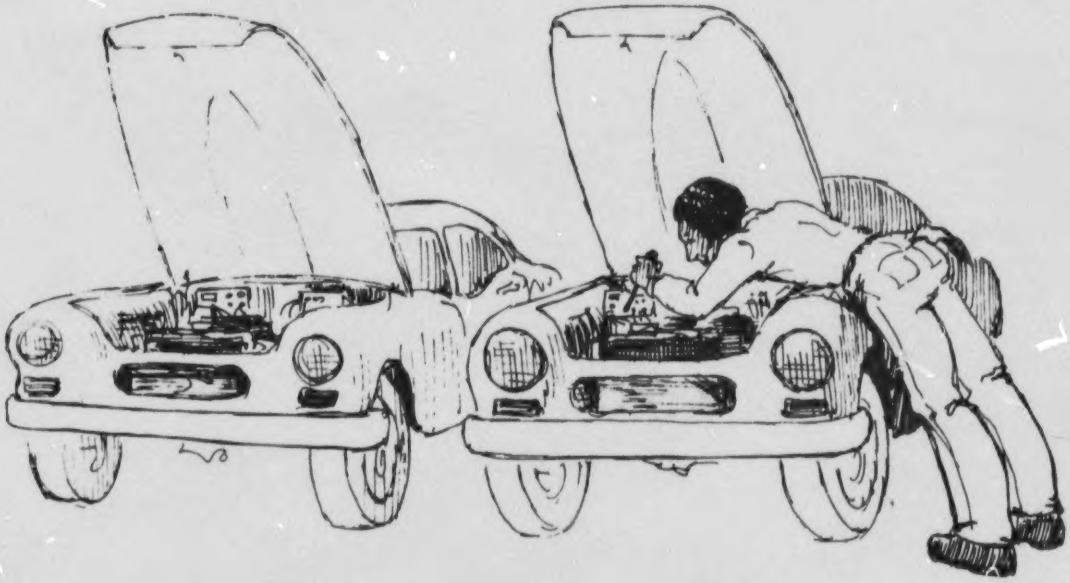
3. **INDUSTRIAL WIRING:** This job consists of wiring major appliances, electric motors and other types of electrical equipment.


ELECTRICAL
REPAIR

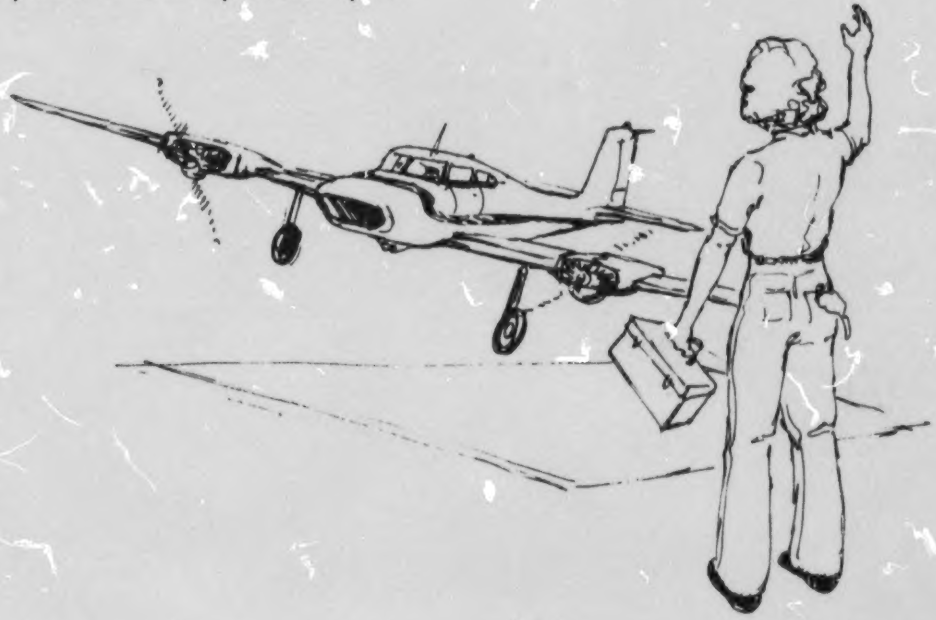
4. **MAINTENANCE WIRING:** This wiring job involves replacing old or broken wires in lamps, appliances or other repairable electrical objects.



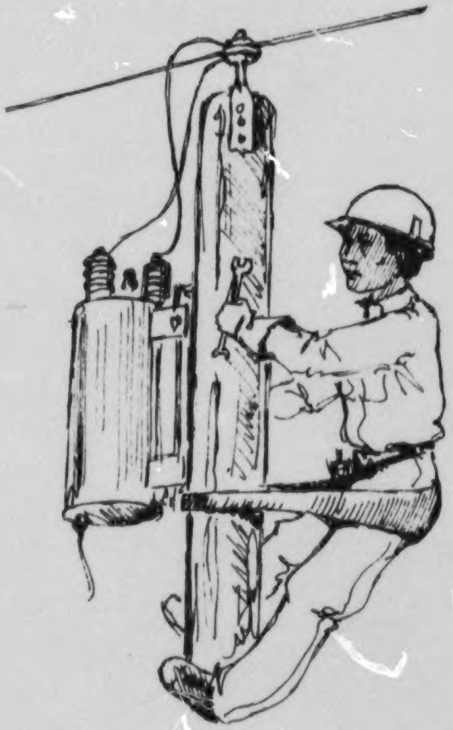
5. **AUTOMOTIVE WIRING:** This type of work is found in automobile industries. A wiring system must be installed in every car to connect the lights, radio, air conditioner and starter to the battery.



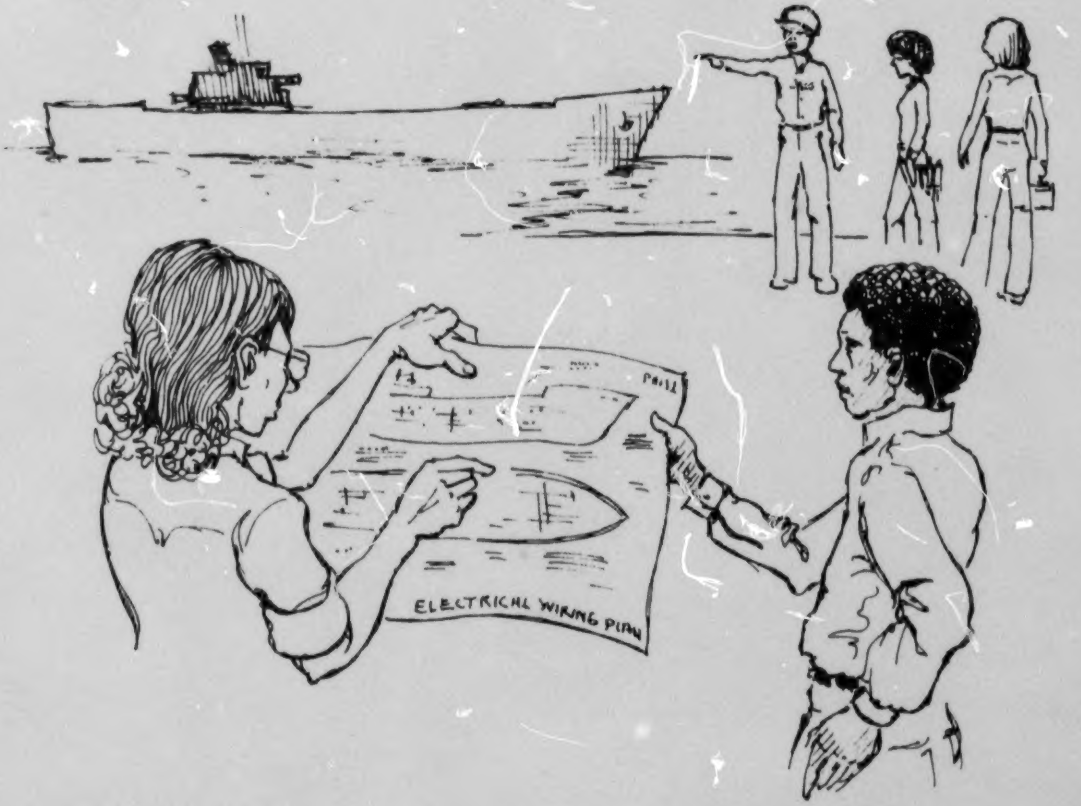
6. **AIRCRAFT AND SPACESHIP WIRING:** This is the installation of electrical wiring to operate the complex electrical parts of airplanes and spaceships.



7. **LINEMAN WIRING:** This is an outdoor wiring job. A lineman installs equipment to carry electricity from a power source to a service entrance and other outdoor jobs.



8. **SHIPBUILDING:** These jobs are available in shipyards. A ship is wired very much like a house. A person who installs wiring in a ship should have the same skills as a residential wiring person.



You have been introduced to the broad areas of electrical wiring. Think about what you have read. Answer the following questions.

1. Name some electrical wiring occupations in your city.
____
____

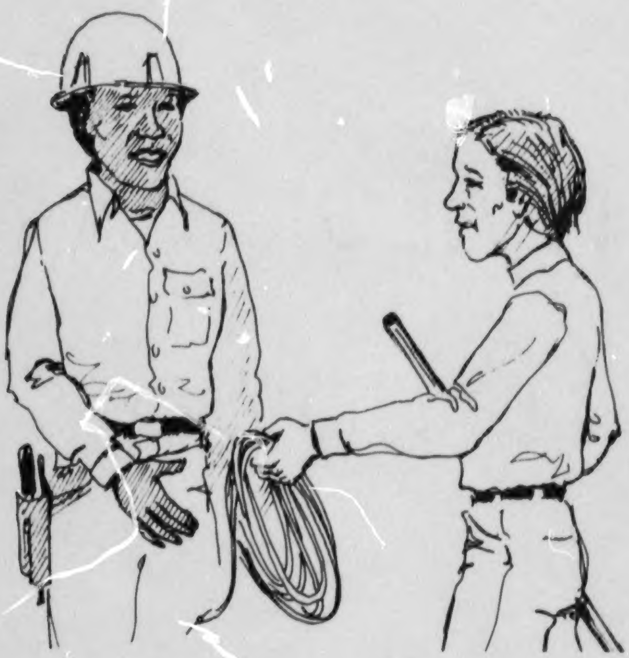
2. Name a business or utility company in your city or area and describe the type of wiring it does. ____________________
____
____

3. Choose an electrical wiring job you would like to do and give a reason for your choice. ____________________
____
____

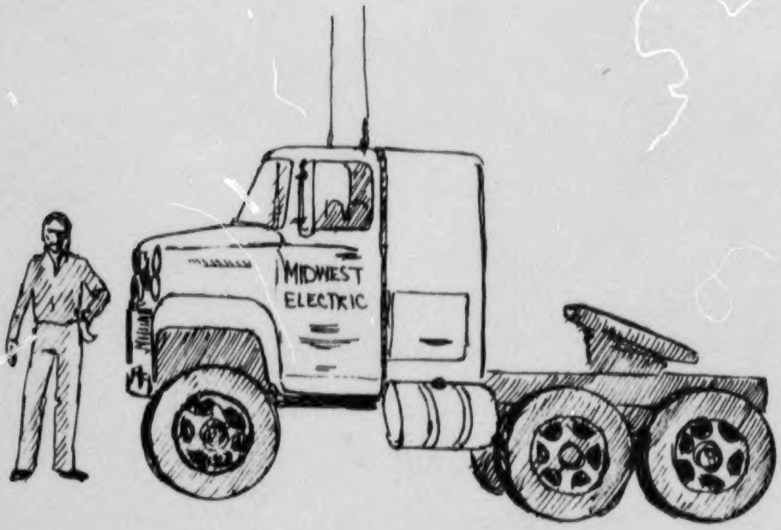
TURN TO NEXT PAGE

B. Job Titles in Electrical Wiring.

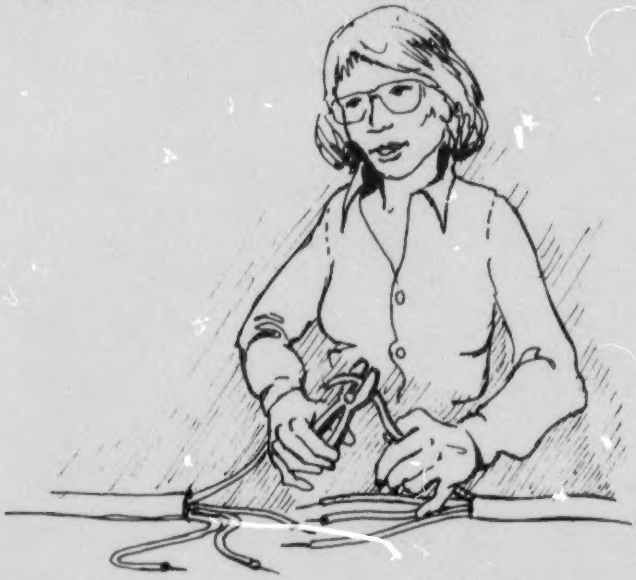
1. **ELECTRICIAN'S HELPER:** Helps arrange electrical materials and supplies to ease wiring work.



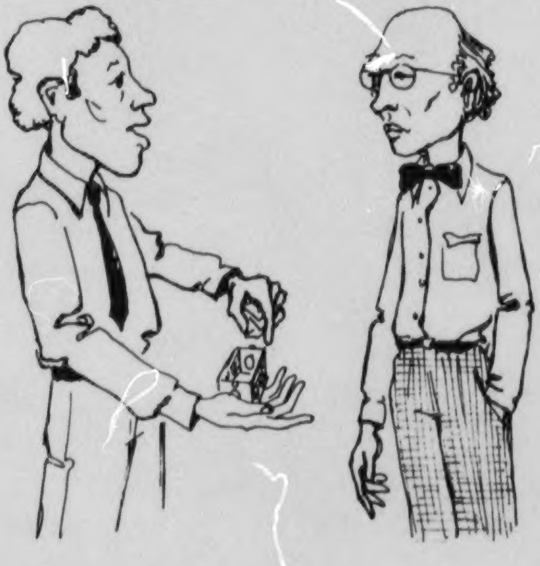
2. **TRUCK DRIVER:** Delivers and picks up electrical equipment and materials.



3. **CABLE SPLICER:** One who connects cables for convenient and safe transportation of electrical current.



4. **ELECTRICAL SALES CLERK:** Person with electrical knowledge who can work in electrical store or department.



Which of these jobs would you like? Why? ______________________________

____

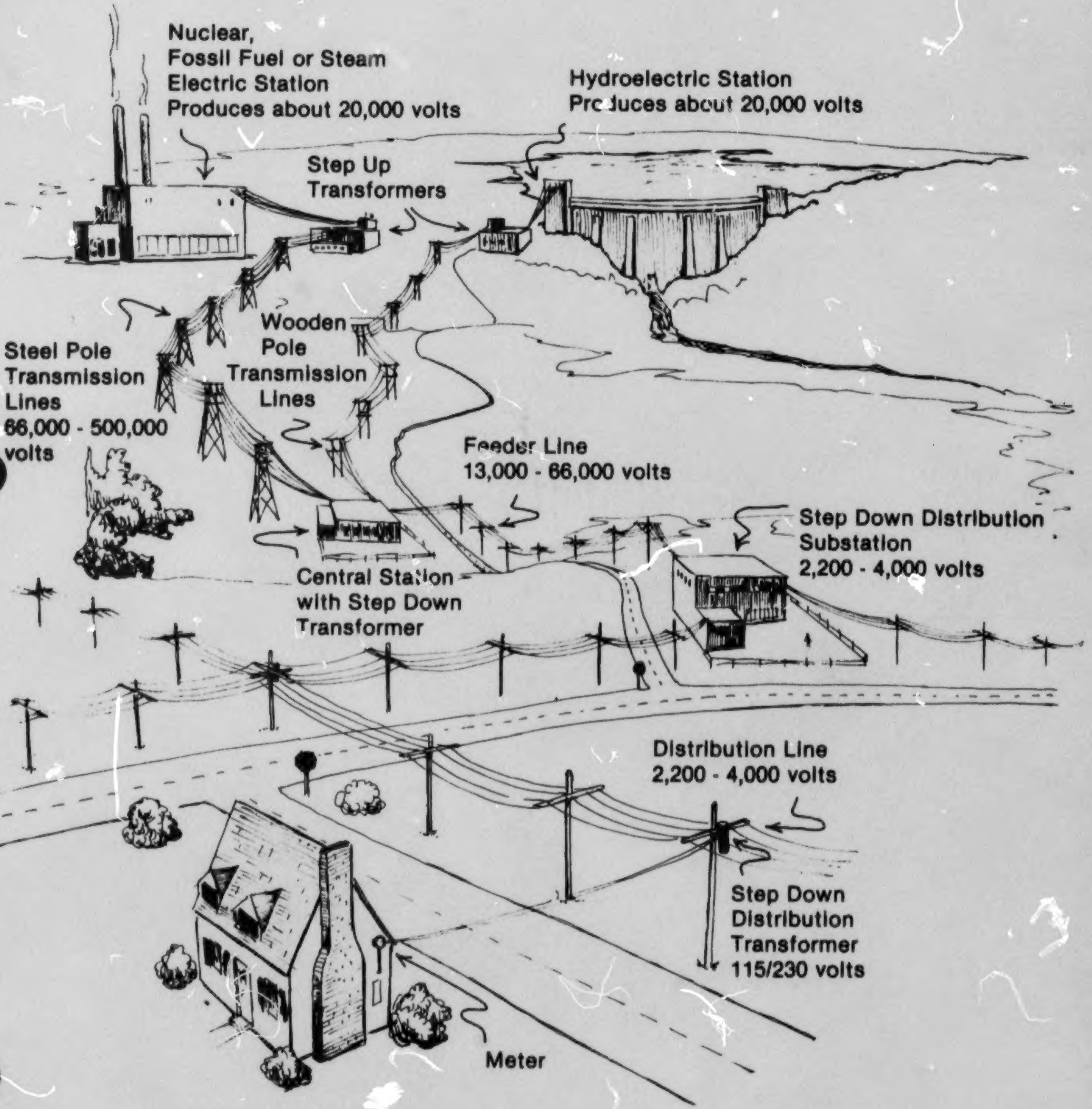
____

____

SEE YOUR INSTRUCTOR

Where Electricity Comes From

Power Sources and Distribution


Nuclear,
Fossil Fuel or Steam
Electric Station
Produces about 20,000 volts
Hydroelectric Station
Produces about 20,000 volts
Step Up
Transformers
Steel Pole
Transmission
Lines
66,000 - 500,000
volts
Wooden
Pole
Transmission
Lines
Feeder Line
13,000 - 66,000 volts
Step Down Distribution
Substation
2,200 - 4,000 volts
Central Station
with Step Down
Transformer
Distribution Line
2,200 - 4,000 volts
Step Down
Distribution
Transformer
115/230 volts
Meter

Unit 1
Jobs Related to Electrical Wiring

Practical Exercise Performance Checklist

Student's Name: ______________________________

True - False Questions:
Circle "T" if the statement is "True" and an "F" if it is "False."

T F 1. Residential wiring is house wiring. It involves the installation of cable for light and appliances in house framing.

T F 2. The wiring of factory buildings and workshops can be called residential wiring.

T F 3. An electrical wiring area involving the wiring of electric motors, other types of electrical appliances and equipment is known as industrial wiring.

T F 4. A maintenance wiring job is either a full-time or part-time electrical wiring occupation.

T F 5. Automotive wiring jobs are like the lineman wiring job because the work is outdoors.

T F 6. Automotive wiring jobs are found in automobile manufacturing industries.

T F 7. The building of spaceships and airplanes does not need electrical wiring.

T F 8. Electrical wiring jobs can be found in shipbuilding yards.

T F 9. One of the responsibilities of an electrician helper is to arrange electrical materials and supplies to ease wiring work.

T F 10. As a truck driver, you must know how to wire a refrigerator.

T F 11. A cable splicer is one who joins cables for safe and convenient use in wiring jobs.

T F 12. With your knowledge in electrical wiring, you could obtain work in the electrical supplies section of a hardware store.

T F 13. Residential wiring does not involve the installation of service entrances in house framing.

T F 14. A maintenance wiring worker can only repair appliances .

Satisfactory Performance ☐
Should Move On ☐
Repeat Exercise ☐

Instructor's Signature ____________ Date ________

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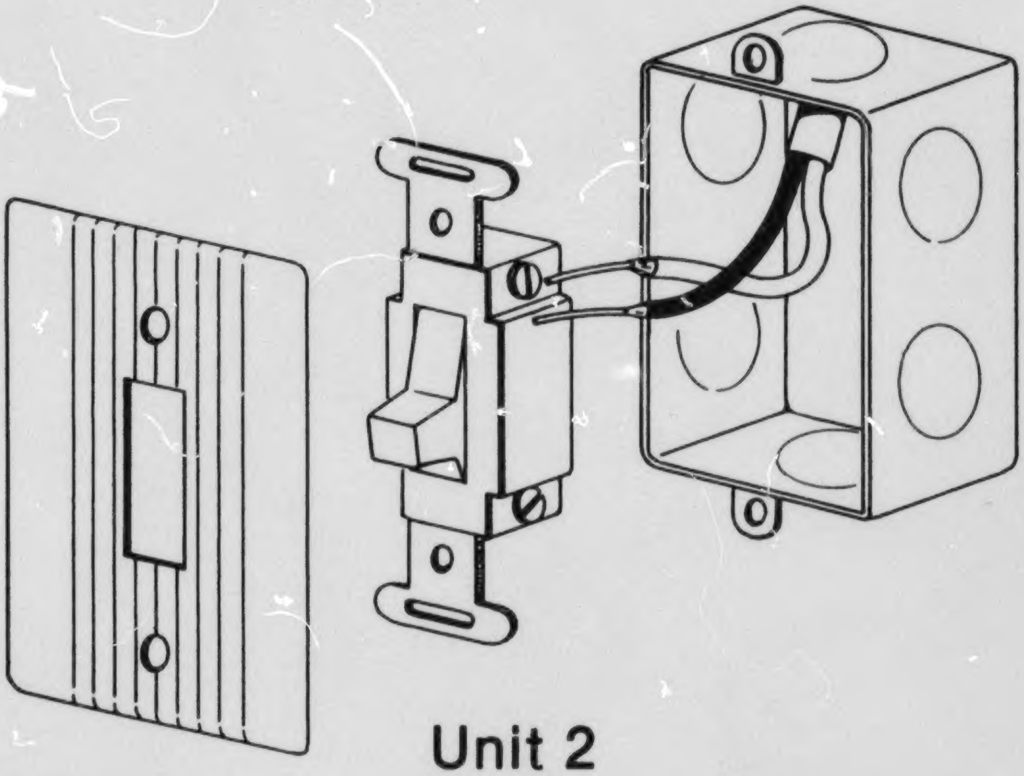
Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 2

Electrical Wiring Tools and Their Uses

Developed by: Hogan Usoro

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Unit 2

Electrical Wiring Tools and Their Uses

Electrical Wiring Tools and Their Uses.

After you study this lesson, you should be able to:

1. Identify the tools used in electrical wiring.
2. Match an electrical wiring tool with its general use.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

   SEE YOUR INSTRUCTOR

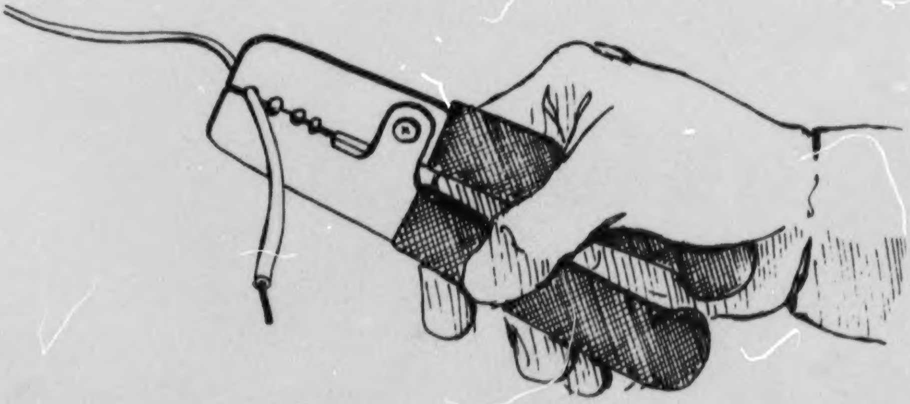
2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

   TURN THE PAGE AND BEGIN

Unit 2
Electrical Wiring Tools and Their Uses

Introduction

Certain tools are needed to do electrical wiring work correctly. Some of these tools such as a measuring tape are very common. These tools can be used in a variety of jobs other than electrical wiring. An example of other tools used only in electrical wiring is the wire stripper or cutter.

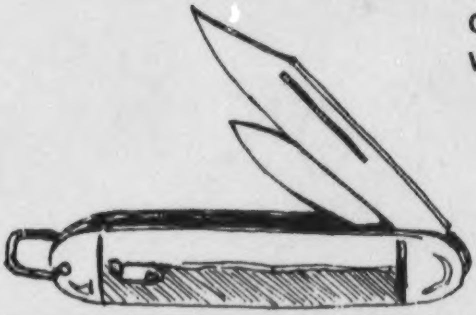
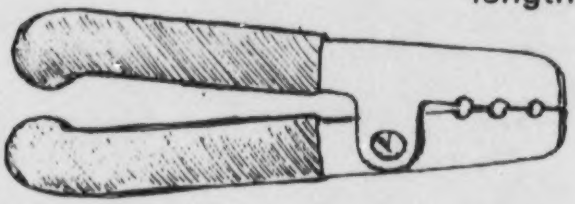
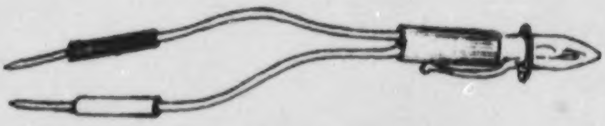


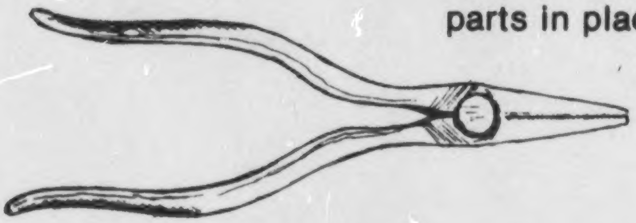
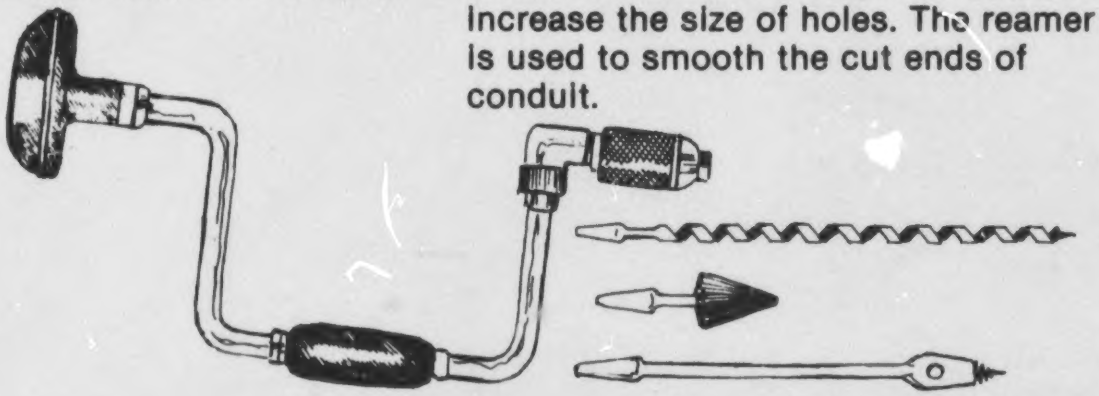
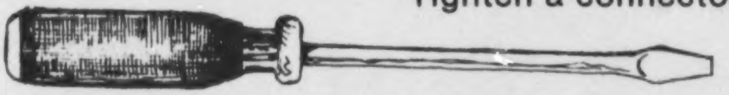
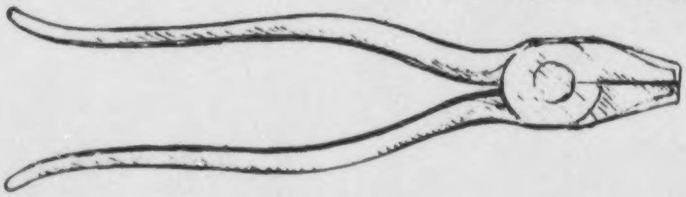
In this unit you will learn about other basic electrical wiring tools and their uses. Now let us begin.

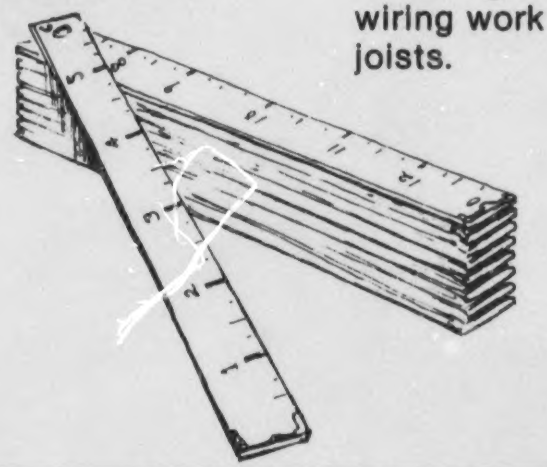
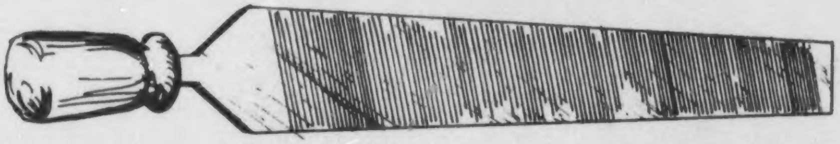
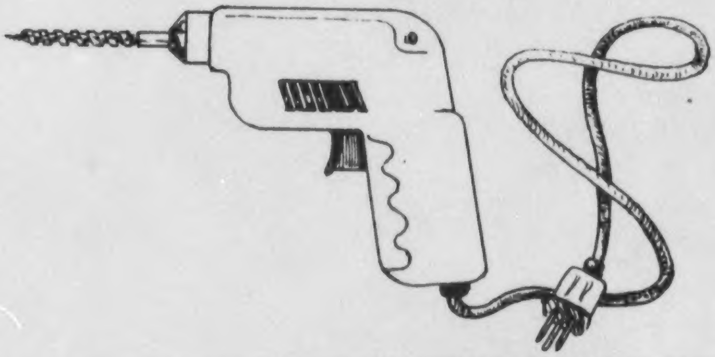
TURN TO NEXT PAGE

Unit 2

Electrical Wiring Tools and Their Uses

TOOL NAME	USE
POCKET KNIFE 	A pocket knife is used to cut the insulating cover of non-metallic (NM) cable. It can also be used to strip wiring.
WIRE CUTTER, STRIPPER 	The wire cutter, stripper is used specifically to strip insulation from bare wire and to cut wire to desired length.
TEST LIGHT 	The test light tests the presence of electrical current in an outlet.

TOOL NAME	USE
LONG-NOSE PLIERS 	Long-nose pliers are most commonly used to bend wires and position small parts in place.
HAND BRACE AND BITS 	A hand brace and bit can drill holes or increase the size of holes. The reamer is used to smooth the cut ends of conduit.
FLATHEAD SCREWDRIVER 	In electrical wiring the flathead is used to: · Loosen or tighten flathead screws. · Install connectors on a cable. · Tighten a connector to the box.
SIDE-CUTTING PLIERS 	Side-cutting pliers are used to cut electrical cable and remove knockouts from electrical boxes.

TOOL NAME	USE
FOLDING RULE 	A folding rule is used for laying out wiring work on studs and ceiling joists.
FILE 	The file is used to smooth the sharp ends of a cut conduit.
ELECTRIC DRILL 	A portable electric drill is used to cut holes in studs and joists for electrical wiring.

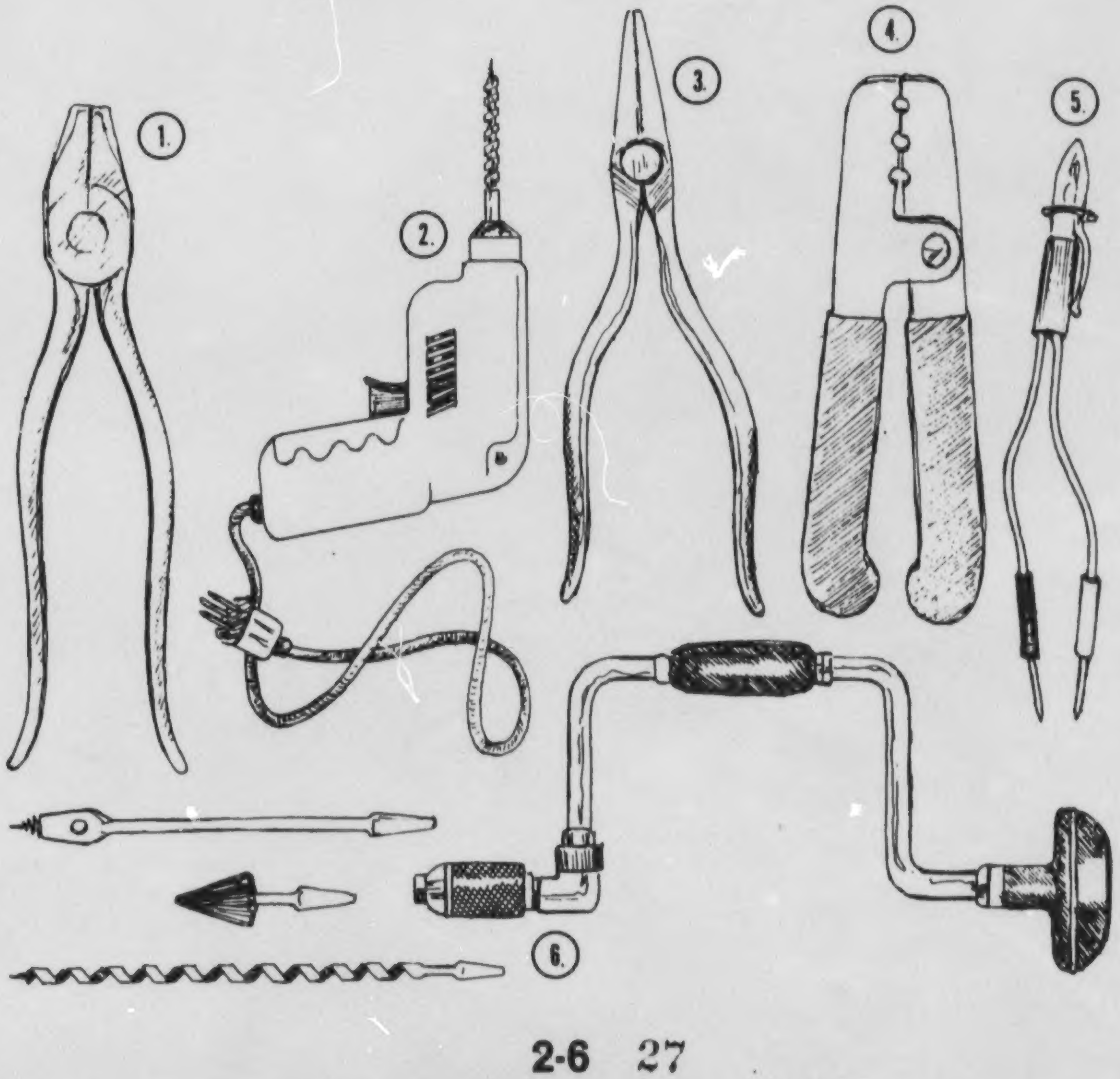
SEE YOUR INSTRUCTOR

Unit 2
Electrical Wiring Tools and Their Uses

A. Tools and Materials Identification Exericise

Match the following tools with their correct names.

______ A. Wire Cutter, Stripper
______ B. Test Light
______ C. Long-Nose Pliers
______ D. Hand Brace and Bits
______ E. Side-Cutting Pliers
______ F. Portable Electric Drill



Unit 2
Electrical Wiring Tools and Their Uses

B. Tools and Materials Identification Exercise

Match the following object or tool with its correct use.

_____ 1. Used to strip insulation from small wire.

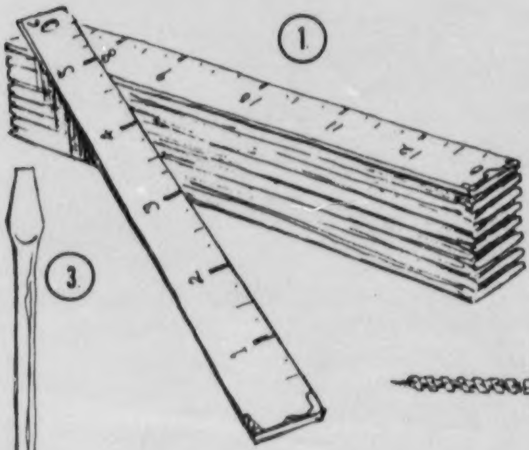
_____ 2. Checks the presence of electrical current.

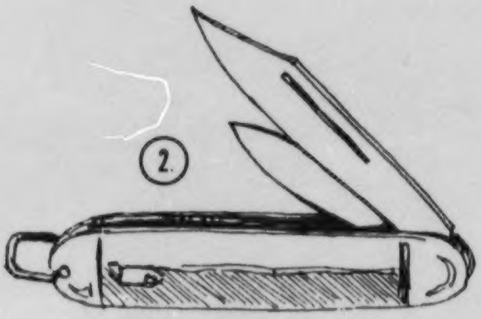
_____ 3. Used to loosen or tighten flathead screws.

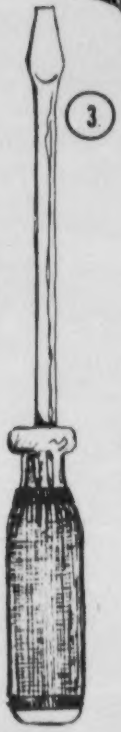
_____ 4. Used for measuring distances on studs and ceiling.

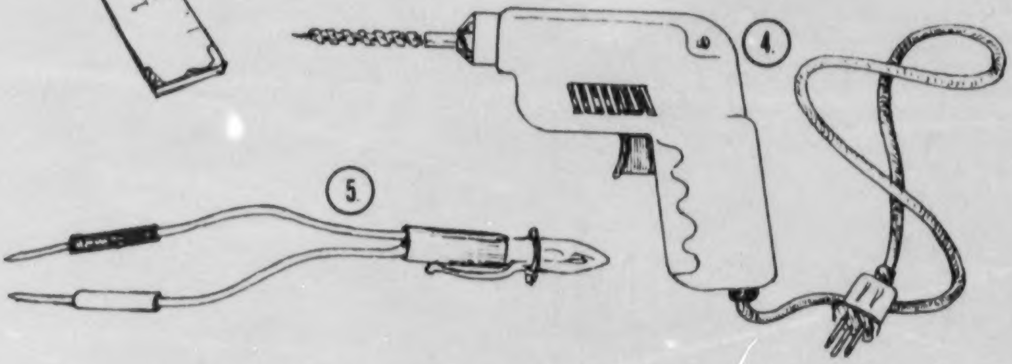
_____ 5. Used to smooth sharp ends of conduit.

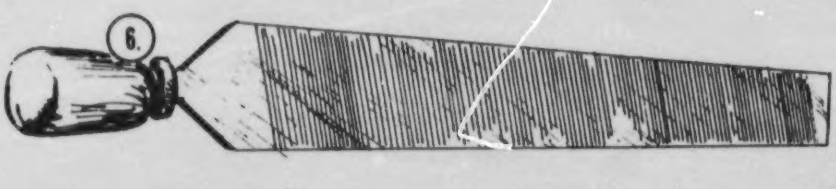
_____ 6. Used to make holes in studs and joists.











Unit 2
Electrical Wiring Tools and Their Uses

Practical Exercise Performance Checklist

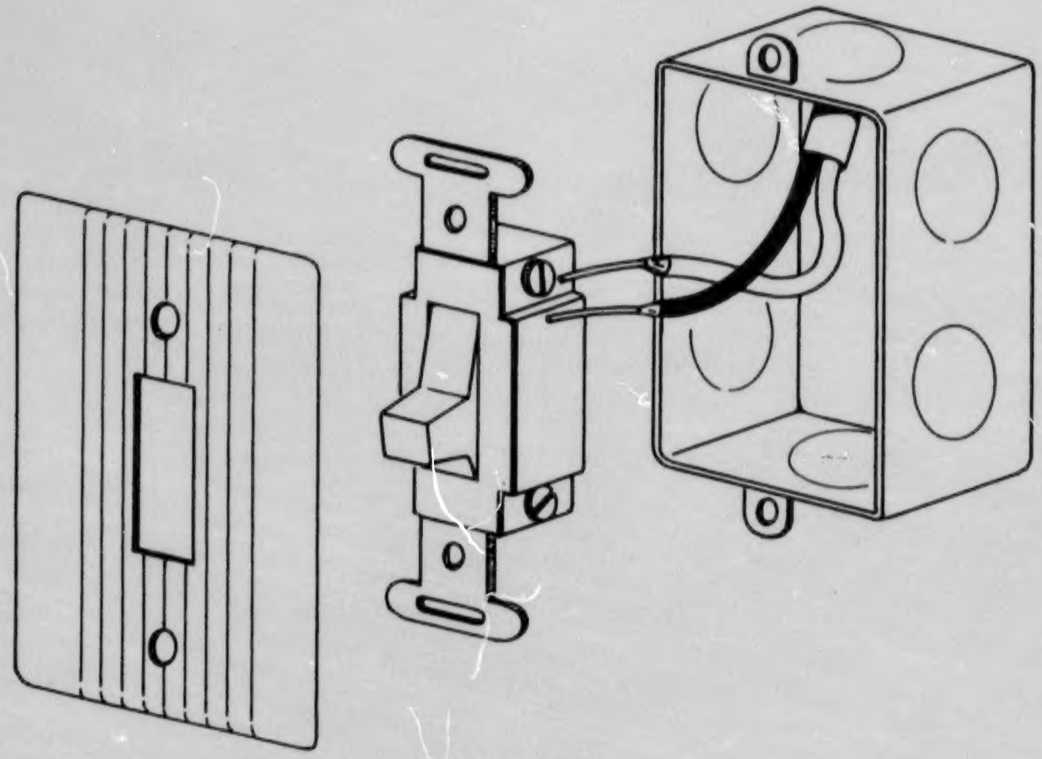
Student ______________________ successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Correctly Identified:			
a. Pocket Knife			
b. Wire Cutter, Stripper			
c. Long-Nose Pliers			
d. Hand Brace and Bits			
e. Flathead Scewdriver			
f. Side-Cutting Pliers			
g. Folding Rule			
h. File			
i. Electric Drill			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ __________
Instructor's Signature Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 3

Wires and Wiring Materials

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION
iMl
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 3

Wires and Wiring Materials

Wires and Wiring Material

After you study this lesson, you should be able to:

1. Identify wire sizes used in house wiring.
2. Match a given wire or conductor with its correct use.
3. Identify types of materials used in electrical wiring.
4. Match a given material with its correct use.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ I can do all the tasks above and want my instructor to give me the Practical Exercise.

SEE YOUR INSTRUCTOR

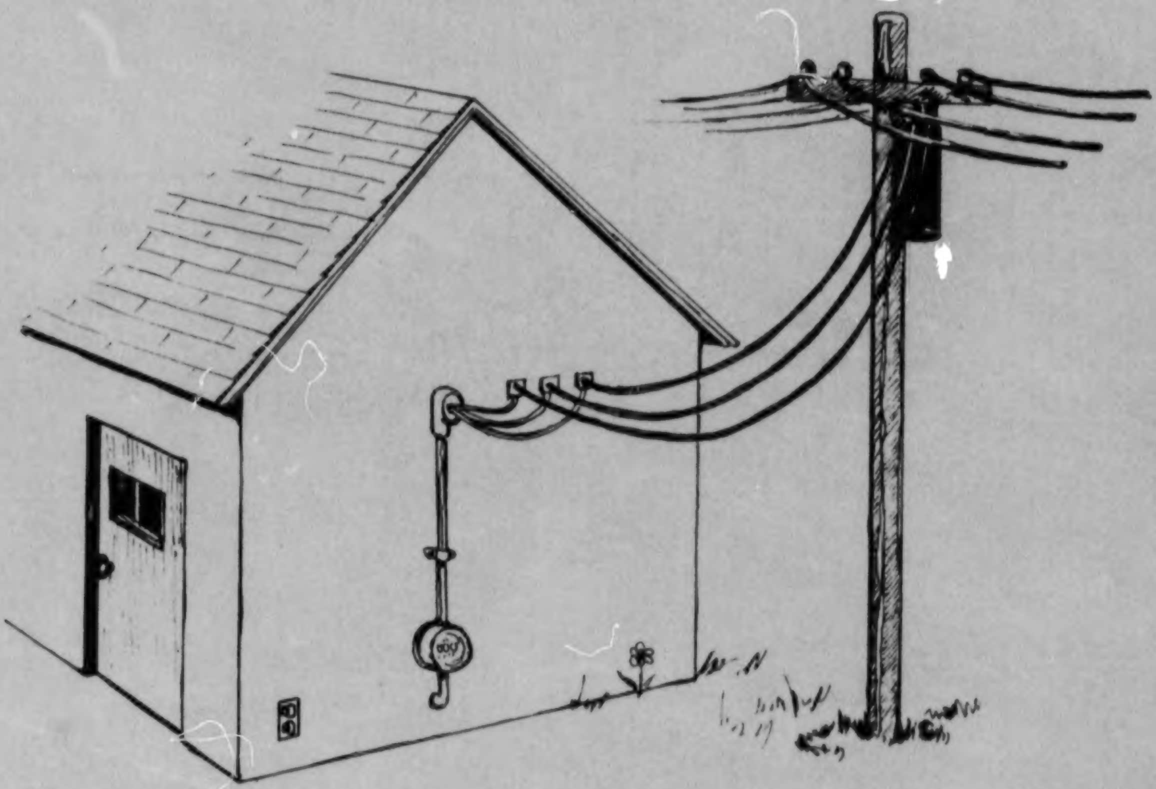
2. ☐ I want to study the information in this unit before I do the Practical Exercise.

TURN THE PAGE AND BEGIN

Unit 3
Wires and Wiring Materials

Introduction

You have learned about electrical wiring tools and their uses. You must also use certain wires and wiring materials with these tools to do electrical wiring properly and safely.



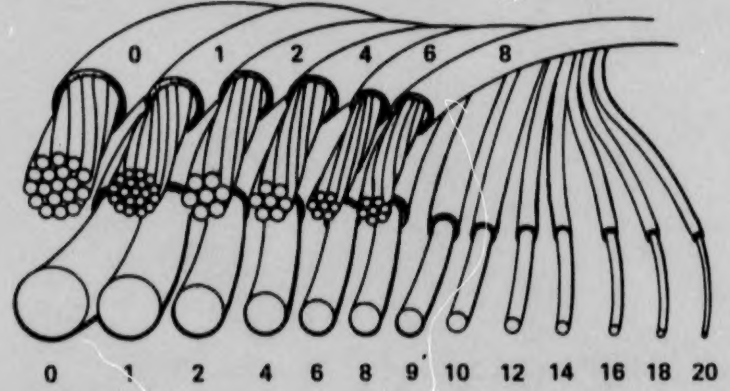
This lesson will show you the different types of electrical wires and materials generally used in wiring jobs.

TURN TO NEXT PAGE

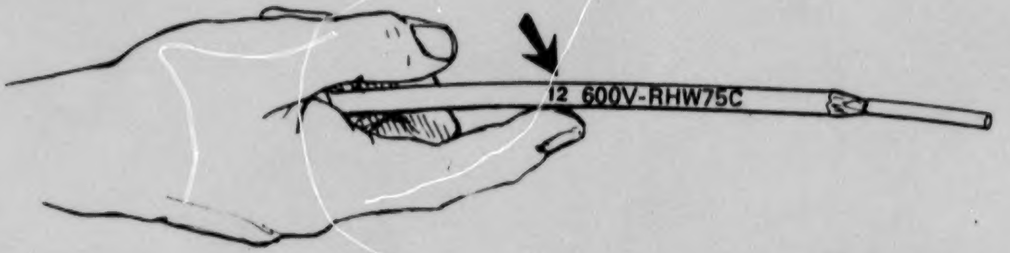
Unit 3
Wires and Wiring Materials

A. Types and Sizes of Electrical Wires

Electrical wires, called conductors, permit electricity to flow through them. There are many types of wire conductors. Wire conductors can be a single large wire or many small wires together.



Numbers are used to indicate wire size. The bigger the number, the smaller the wire is. The smaller the number, the bigger the wire is.



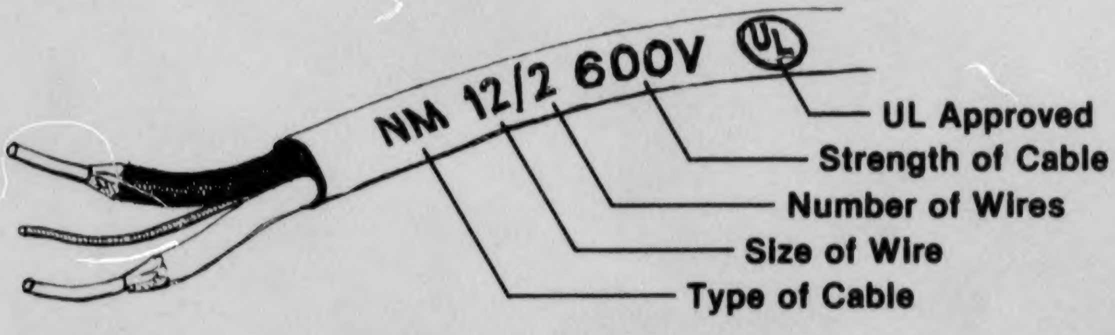
The most commonly used wire in house wiring is a copper wire size number 12.

Size of wires used in house wiring depends on requirements of the National Electrical Code. The Code is a law. This Code sets standards of safety for wiring materials and practices. The Code requires that wire, wiring materials or practices be approved and tested by Underwriters' Laboratories. Wires and materials that are approved will have a Ⓤⓛ seal of approval on them.

TURN TO NEXT PAGE

B. Types and Sizes of Electrical Cables

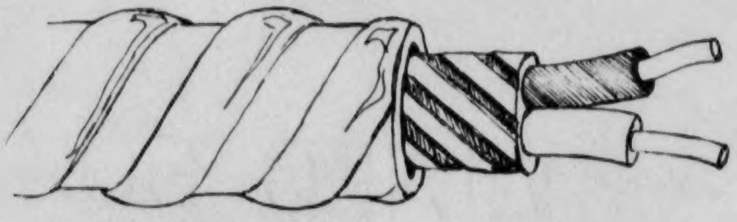
An electrical cable contains two or more wires. Each wire has a rubber or plastic covering to insulate and protect the bare wire.


NM 12/2 600V UL
UL Approved
Strength of Cable
Number of Wires
Size of Wire
Type of Cable

Each electrical cable is marked to show type, size and number of wires, and strength of the cable.

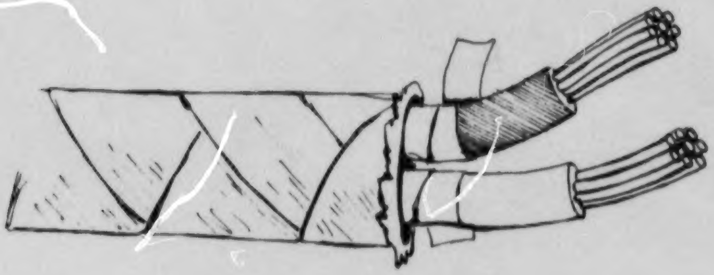
The Most Commonly Used Electrical Cables Are:

1. **FLEXIBLE ARMORED CABLE:** This cable is used in interior work and in locations where damage to the wire may occur after installation.

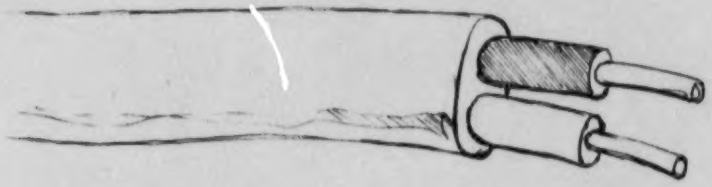


Armored cable should not be used in wet locations.

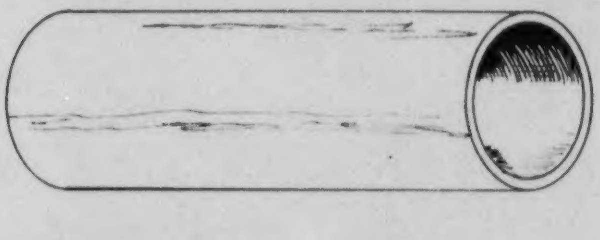
2. **SERVICE ENTRANCE CABLE:** Heavy duty cable used for outside wiring from the utility pole to the location where electricity enters the building. This location is the service entrance.



3. **NON-METALLIC (NM) SHEATHED CABLE:** A flat or oval-shaped cable used indoors and in dry locations. The cable is easy to work with because it is flexible.



4. **METAL CONDUIT:** Metal conduit is not a cable but is a tubing that provides protection for wires. Metal conduit can be used inside,but it is required for outdoor installations.

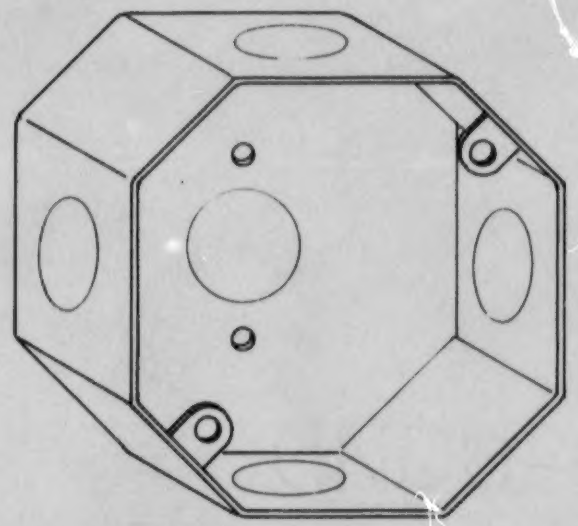


C. Types and Sizes of Electrical Boxes.

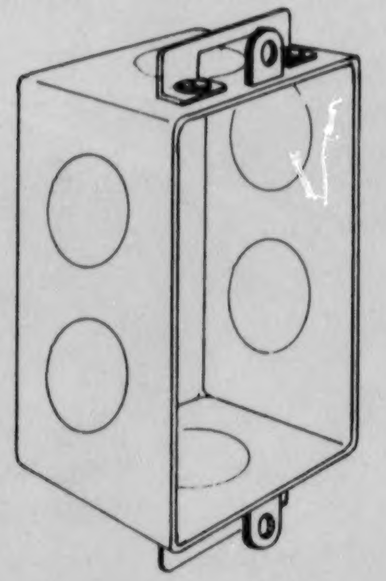
Electrical boxes, like wires and cables, serve different purposes.

The Most Commonly Used Boxes Include:

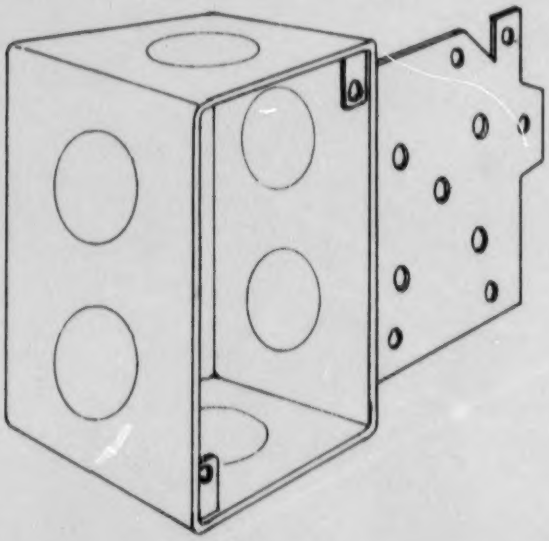
1. **OCTAGONAL BOX:** Metal container used to hold ceiling lamps.



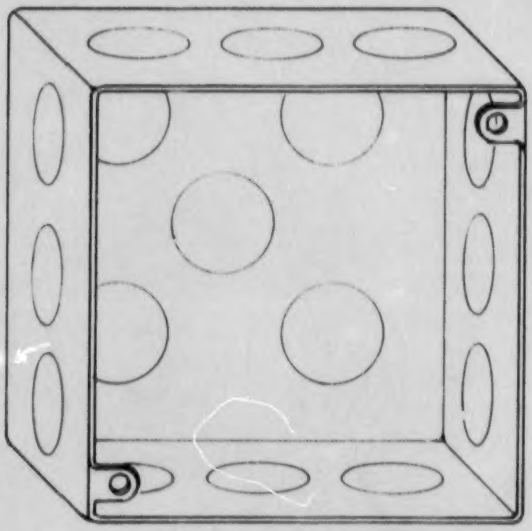
2. **RECTANGULAR BOX:** Metal box used for wall switch or outlet receptacle.



3. **SIDE BRACKET BOX:** Box used for switches or receptacles in new buildings. It is attached to studs by the side bracket.

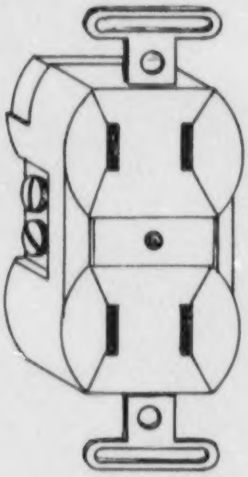


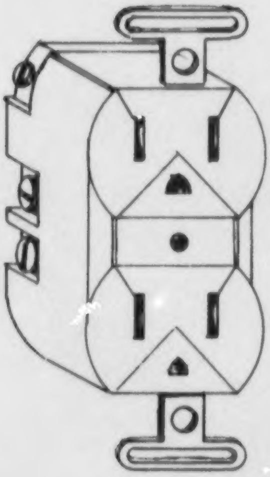
4. **SQUARE BOX:** Metal container used to hold outlet. Larger sizes can hold more than one outlet.

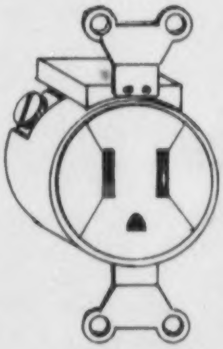


D. Types and Sizes of Electrical Receptacles

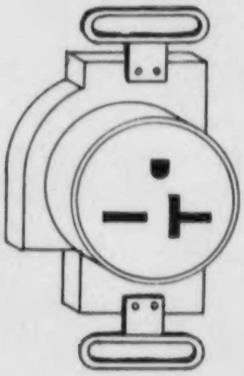
Electrical receptacles provide an outlet to plug in cords for radios, lamps or electrical appliances. Receptacles are either two-pronged or three-pronged. Three-pronged receptacles are suggested for safety.

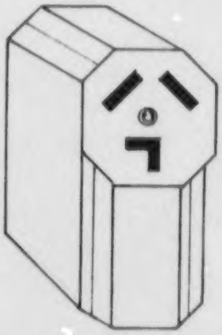


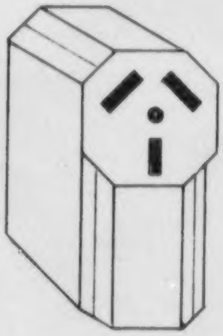




Heavy duty receptacles for higher voltages (220-240) are used for larger appliances like a washer, or dryer or air conditioner. These receptacles have differently shaped plug-in slots.

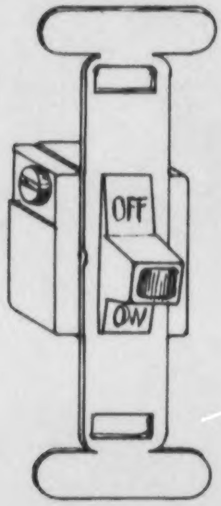




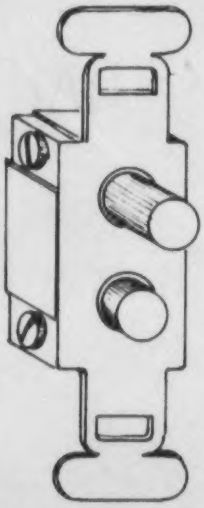


E. Types and Sizes of Electrical Switches.

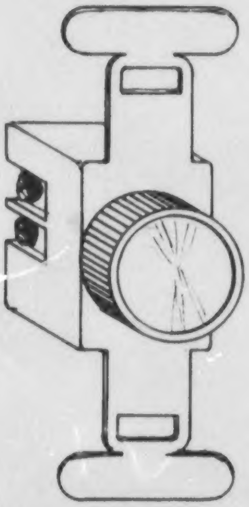
Switches are used to turn on or off the flow of electric current. The three basic switches currently used in home wiring are:



Toggle Switch



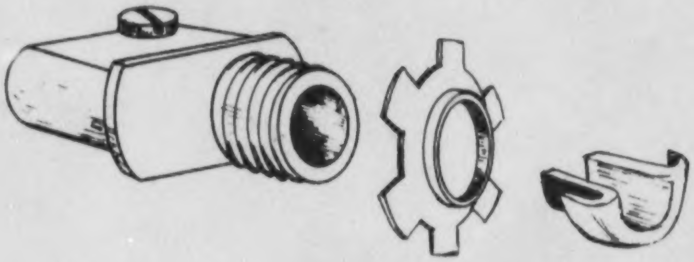
Push Button Switch



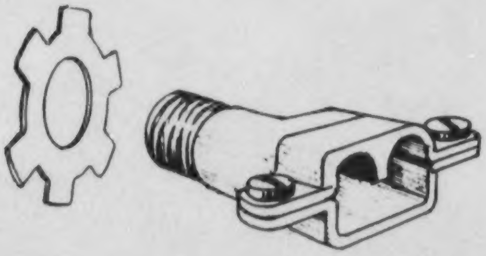
Dimmer Switch

F. Types and Sizes of Electrical Connection Devices

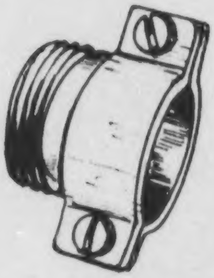
Connector used to secure armored cable to the electrical box.



Connector used to secure non-metallic cable to an electrical box.

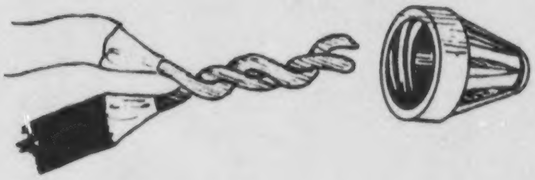


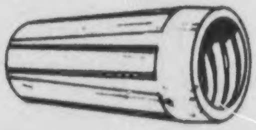
Connector used to secure metal conduit to an electrical box.



G. Types and Sizes of Wire Nuts

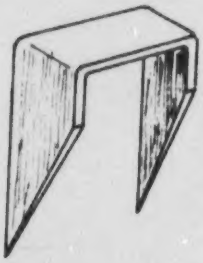
Wire nuts are plastic caps which are screwed over the ends of stripped and twisted wire connections.



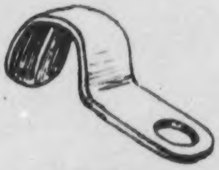


H. Types and Sizes of Staples, Hangers and Straps

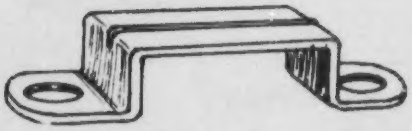
Staples, hangers and straps are all used to secure cables in place.



Staple



Hanger



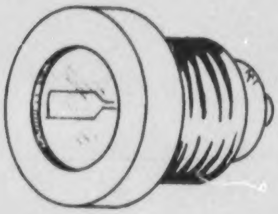
Strap

I. Types and Sizes of Electrical Safety Devices

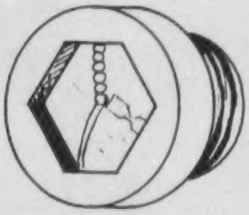
Electrical safety devices are used to prevent electrical wires from overheating and causing fire. Electrical wires overheat when too much current flows through them. When too much current flows through electrical path, the safety device stops the flow of electricity.

The Most Common Electrical Safety Devices Include:

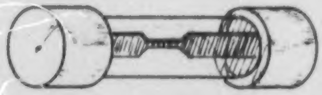
1. **FUSES:** A fuse burns out when the electrical path they protect is overheated. A burned out fuse cannot be reused.



Plug-Type

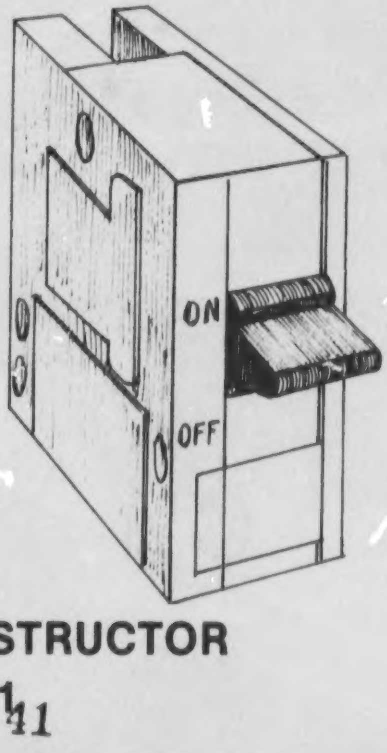


Time-Delay



Cartridge Fuse

2. **CIRCUIT BREAKER:** A circuit breaker automatically shuts off or "trips" to break the flow of current when the electrical path it protects is overloaded. A circuit breaker can be reset by pushing the switch back to "ON."



SEE YOUR INSTRUCTOR

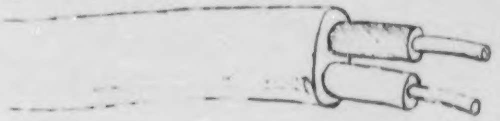
Unit 3
Wires and Wiring Materials

Materials Identification Exercise

Match the names with the correct objects.

_____ A. Flexible Armored Cable
_____ B. Service Entrance Cable
_____ C. Non-Metallic Sheathed Cable
_____ D. Metal Conduit
_____ E. Dimmer Switch
_____ F. Wire Nut
_____ G. Staple
_____ H. Fuse
_____ I. Circuit Breaker
_____ J. Push Button Switch

①



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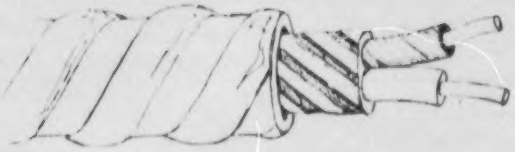

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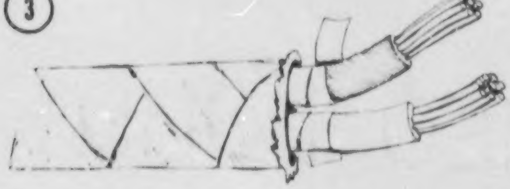

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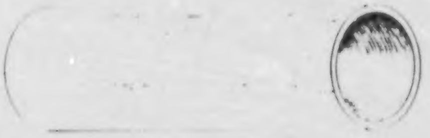

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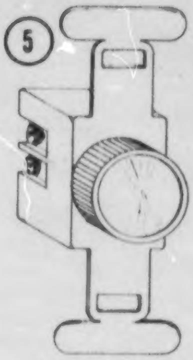

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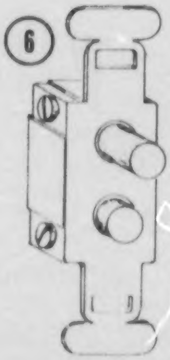

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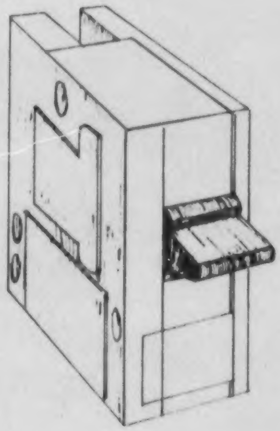

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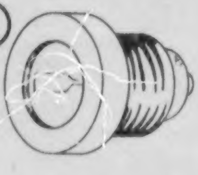

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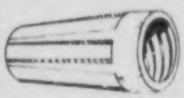

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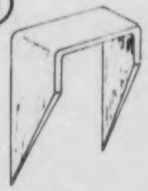


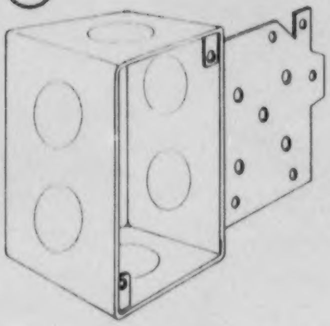
Unit 3
Wires and Wiring Materials

Materials Identification Exercise

Match the uses with the named objects.

_____ A. Eight sided box for holding ceiling lamps.
_____ B. A metal box used for a switch or receptacle.
_____ C. A metal box used to install a switch or receptacle in a new building.
_____ D. A safety device which stops the flow of electricity when an electrical circuit overheats.
_____ E. A device used to secure non-metallic cable to the box.
_____ F. Metal tubing that provides protection for wires.

①



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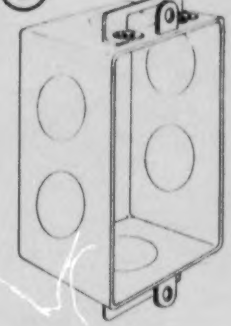

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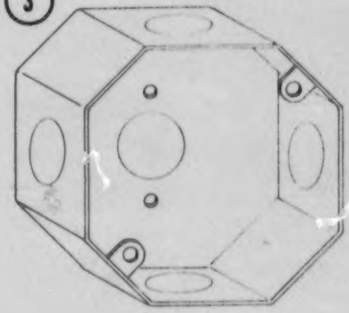

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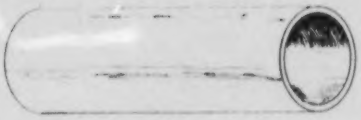

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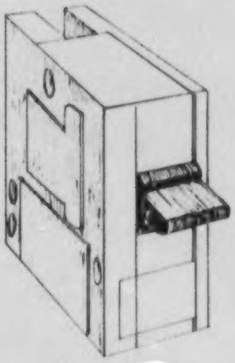

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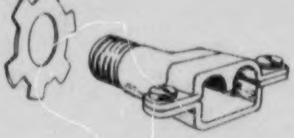


Unit 3
Wires and Wiring Materials

Practical Exericise Performance Checklist

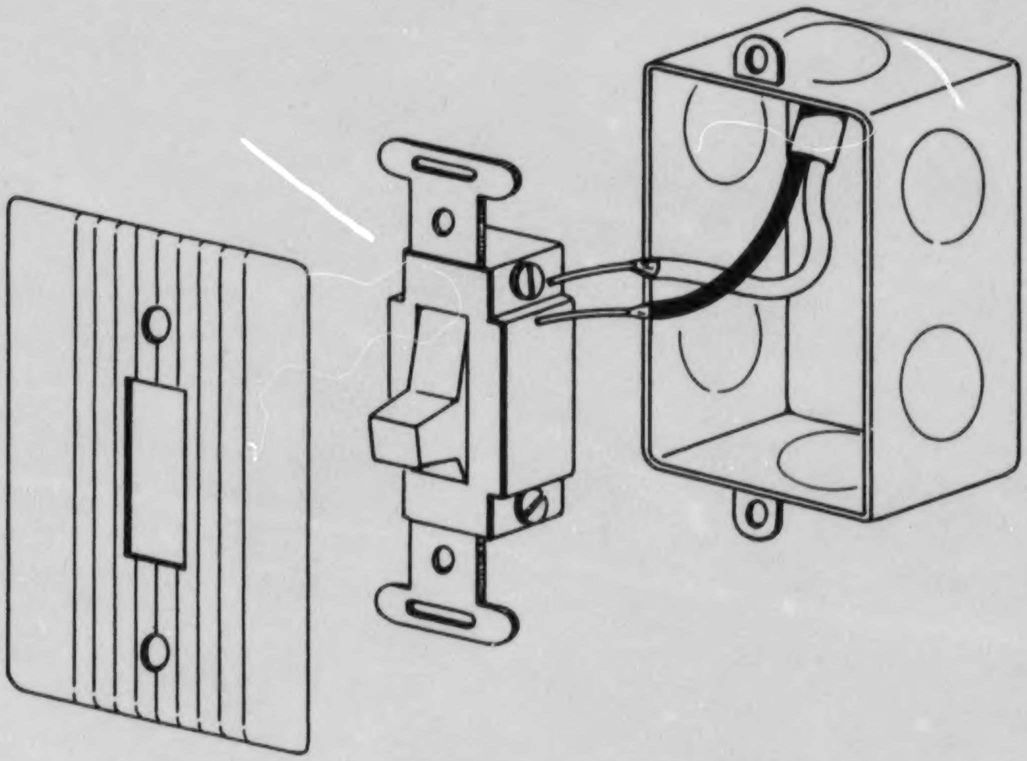
Student ______________________ successfully performed the following tasks:

Tasks	Yes	No	Comments
Identified Types and Sizes of: 1. Electrical Wires			
2. Electrical Cable			
a. Flexible Armored Cable			
b. Service Entrance Cable			
c. Non-metallic Cable			
d. Metal Conduit			
3. Electrical Boxes			
a. Octagonal Box			
b. Rectangular Box			
c. Side Bracket Box			
d. Square Box			
4. Electrical Receptacles			
5. Electrical Switches			
6. Electrical Connection Devices			
7. Wire Nuts			
8. Staples, Hangers, and Straps			
9. Fuses			
10. Circuit Breaker			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ ________
Instructor's Signature Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 4

Safety Rules in Electrical Wiring

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
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INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 4
Safety Rules in Electrical Wiring

Safety Rules in Electrical Wiring

After you study this lesson, you should be able to:

1. Identify an unsafe situation or environment for electrical wiring.
2. Work safely in the electrical workshop or on the wiring job.
3. Perform a well done electrical job to avoid fires and shock.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

   SEE YOUR INSTRUCTOR

2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

   TURN THE PAGE AND BEGIN

Unit 4
Safety Rules in Electrical Wiring

Introduction

Electricity is useful but it can be dangerous too, especially if you do not respect how it works. In order to benefit from its usefulness, you must learn to work with it in a **safe** manner.

You must be concerned with safety when working with electricity. Electrical shock and fires destroy lives and property every day. Many times carelessness and faulty electrical wiring are the causes of these fires.

In this lesson, you will learn about some of the safety rules you must observe while working with electricity.

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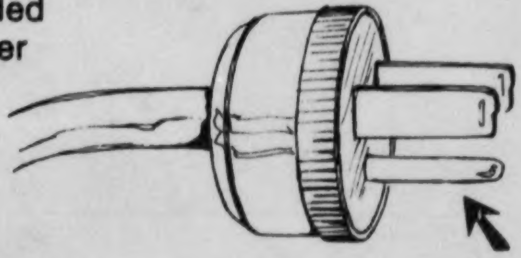
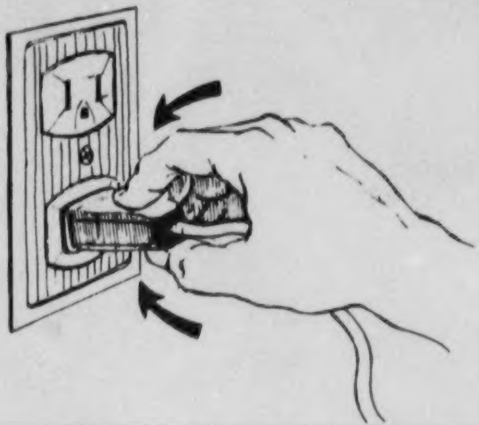
Unit 4

Safety Rules in Electrical Wiring

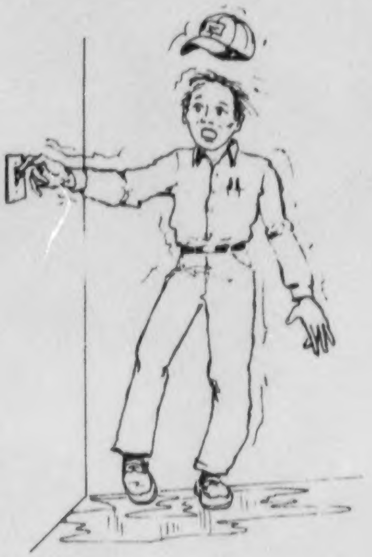
NEVER cut off the grounded prong of an electrical plug. The grounded plug makes appliances and power safer to use.



ALWAYS unplug electrical cords by pulling the plug instead of the cord.
Pulling on the cord can damage the wiring in the plug.

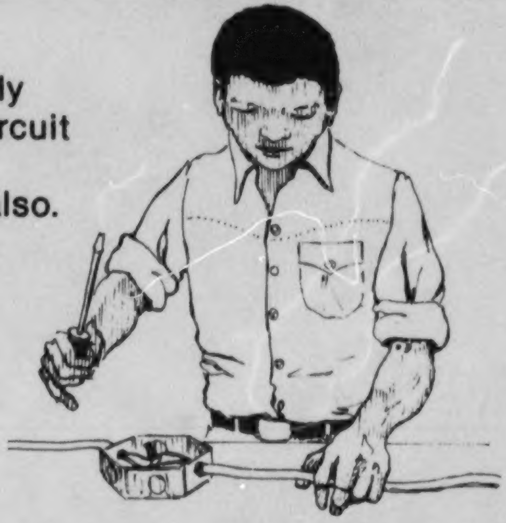


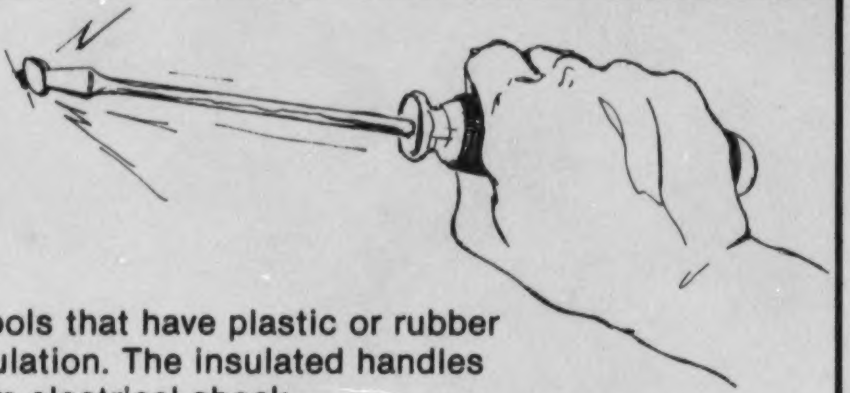
NEVER switch an electrical device on or off when you are wet or while standing in water.
Water conducts electrical current.



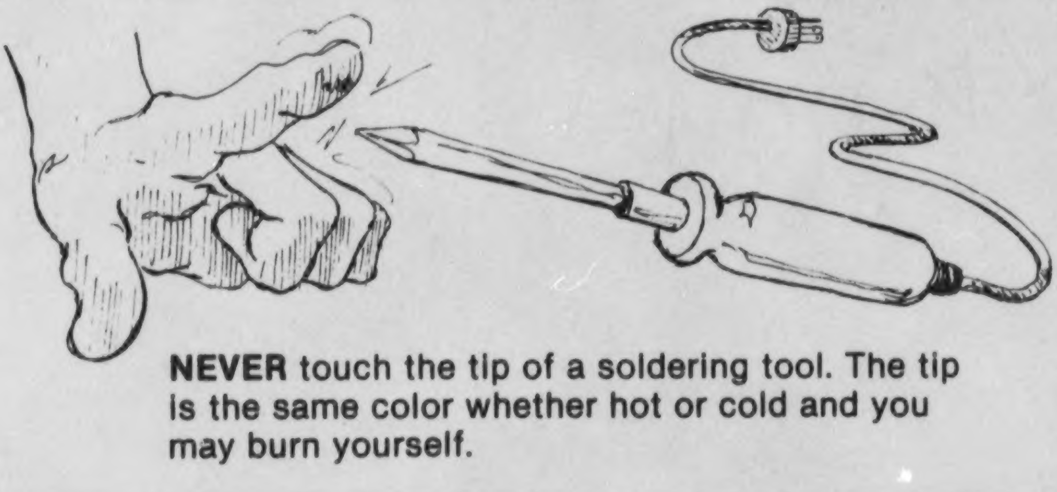
Safety Rules in Electrical Wiring

ALWAYS check your work carefully before connecting an electrical circuit to its power source. Have your supervisor or instructor check it also.



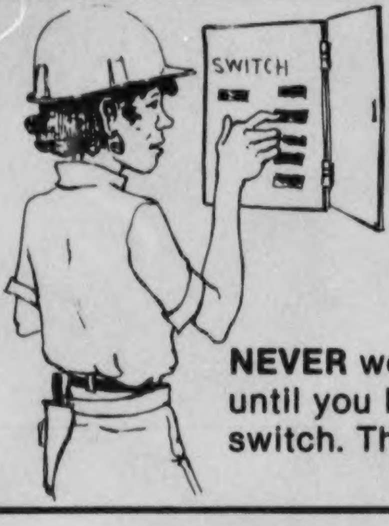


ALWAYS use tools that have plastic or rubber handles for insulation. The insulated handles protect you from electrical shock.

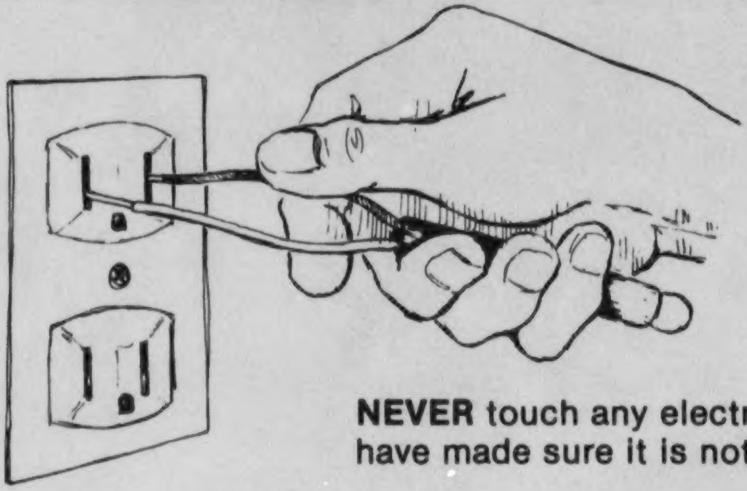


NEVER touch the tip of a soldering tool. The tip is the same color whether hot or cold and you may burn yourself.

Safety Rules in Electrical Wiring

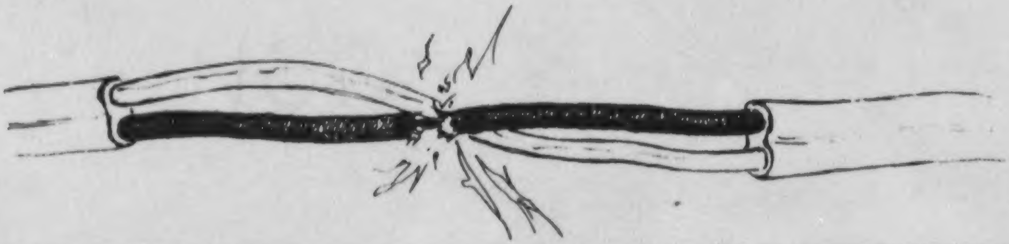


NEVER work on an electrical path or circuit until you have located and disconnected the master switch. The master switch controls power.

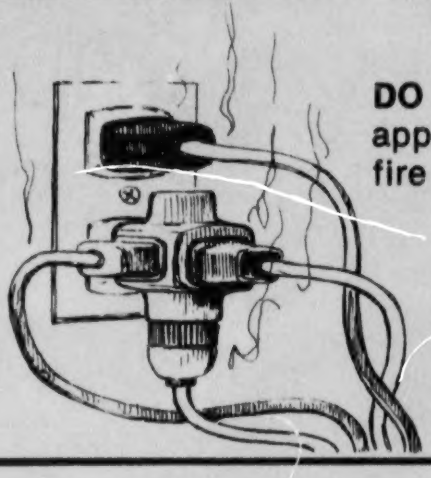


NEVER touch any electrical wire until you have made sure it is not a live wire.

DO NOT allow bare wires carrying current to touch. A fire may result if they do.

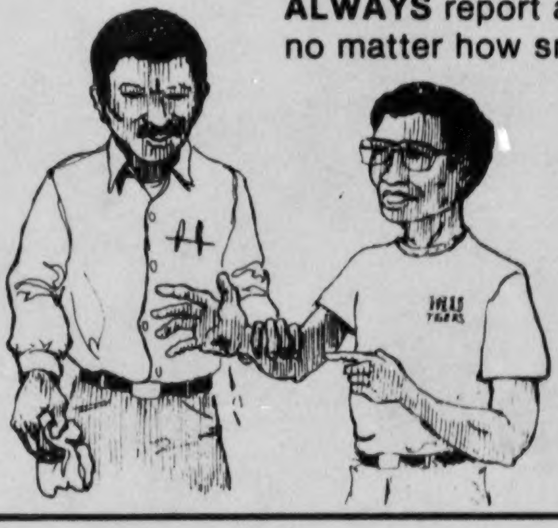


Safety Rules in Electrical Wiring

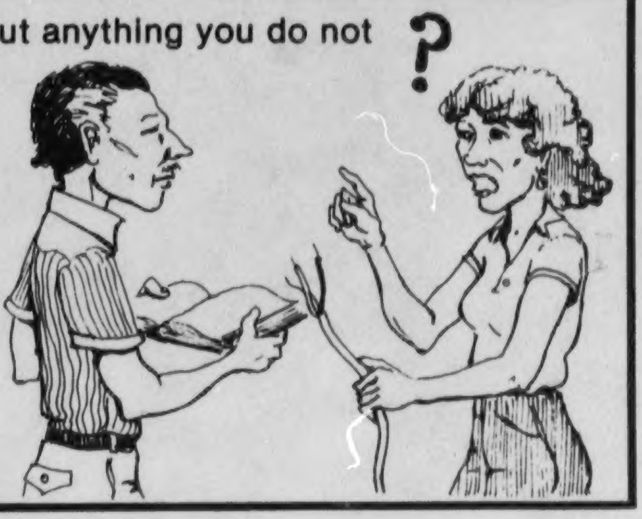


DO NOT overload a circuit with too many appliances. The wires may overheat and a fire can result.

ALWAYS report accidents to your instructor, no matter how small they may seem to be.

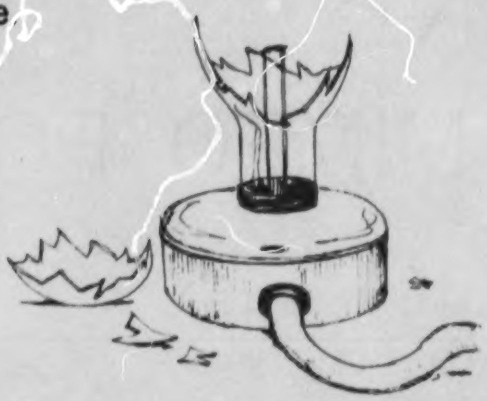


ALWAYS ask questions about anything you do not fully understand when doing electrical work.

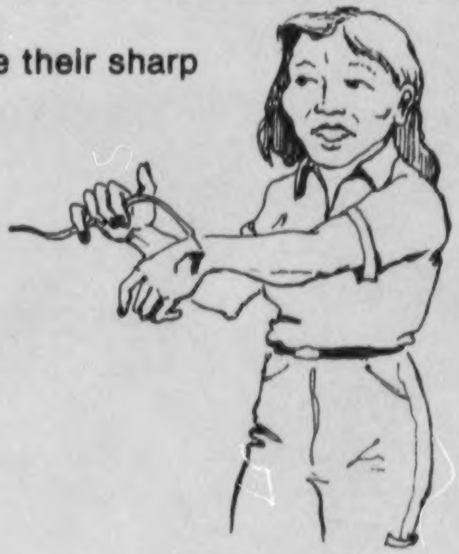


Safety Rules in Electrical Wiring

Handle broken lamp bulbs with caution because you can cut yourself on the broken edge.



Handle bare wires carefully because their sharp ends can cause injury.



SEE YOUR INSTRUCTOR

Unit 4
Safety Rules in Electrical Wiring

Practical Exercises Performance Checklist

Student's Name: ______________________________

True-False Questions:

Circle "T" if the statement is "True" and "F" if it is "False."

T F 1. Overloading a circuit with too many appliances can cause overheating and fire.

T F 2. Nothing happens when bare ends of current-carrying wires touch.

T F 3. It is important that you report accidents to your instructor, no matter how small they may seem to be.

T F 4. The ends of bare wires should not be handled carelessly.

T F 5. It is unsafe for you to work with electricity when you are wet or standing in water.

T F 6. It is much safer to unplug an electrical cord by pulling the plug instead of the cord.

T F 7. Grounded plugs are safer to use than ungrounded ones.

T F 8. Electrical tools with plastic or rubber handles help prevent an electric shock.

T F 9. It is safe to touch the tip of a soldering tool when it is not red hot.

T F 10. It is always advisable to ask questions about the things you do not fully understand before doing electrical wiring work.

T F 11. You may touch an electrical wire with your hand to find out whether it is alive or dead.

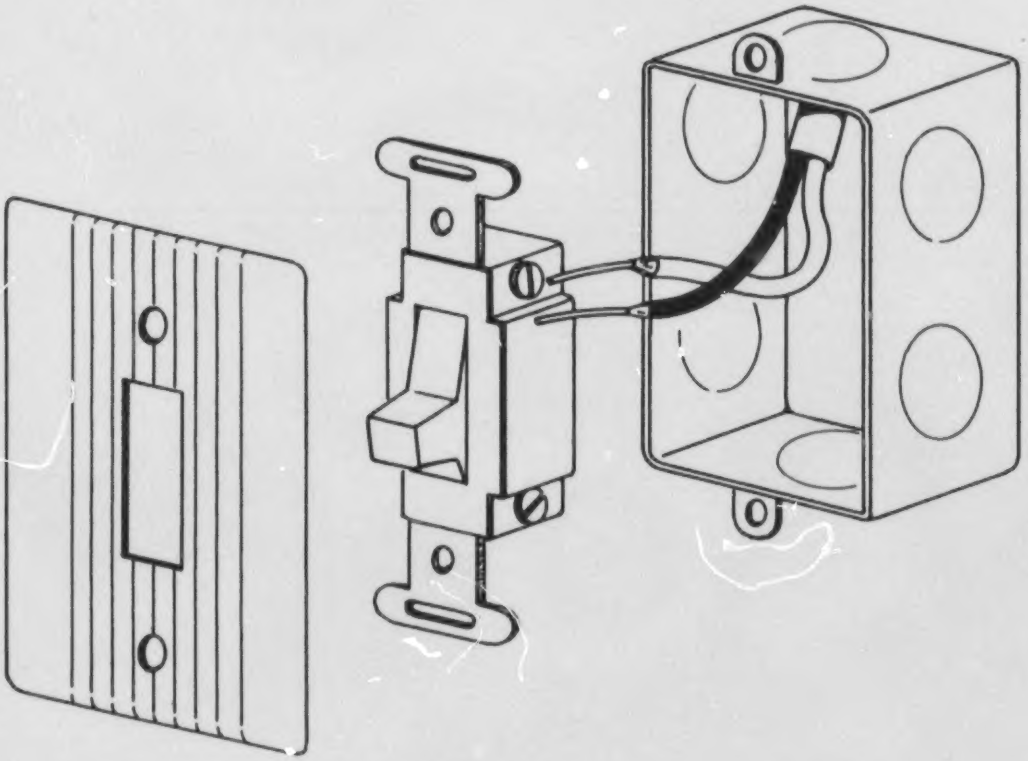
T F 12. Never work on an electrical circuit until you have found and disconnected the master switch.

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ Instructor's Signature

________ Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 5

Splicing Electrical Wires

Developed by: Hogan Usoro

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Unit 5
Splicing Electrical Wires

Splicing Electrical Wires

After you study this lesson, you should be able to:

1. Identify tools and materials used to connect electrical wires.
2. Make a pigtail splice.
3. Make a tap splice.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

SEE YOUR INSTRUCTOR

2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

TURN THE PAGE AND BEGIN

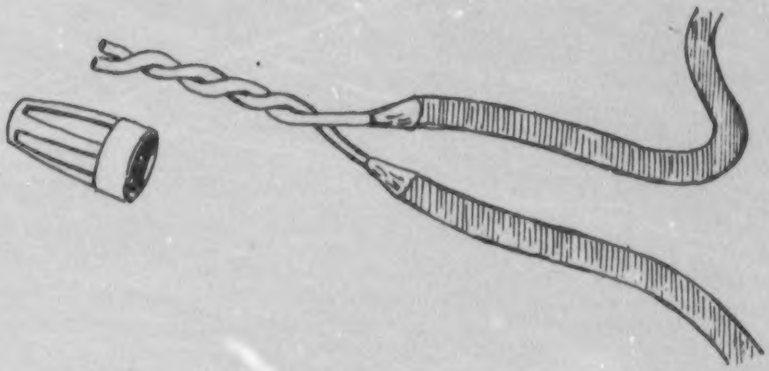
Unit 5
Splicing Electrical Wires

Introduction

An electrical connection made by twisting wires together is called a splice.

Reasons you make electrical wire splices are:

1. to join shorter wires to make a longer piece.
2. to tap electricity from a main line.



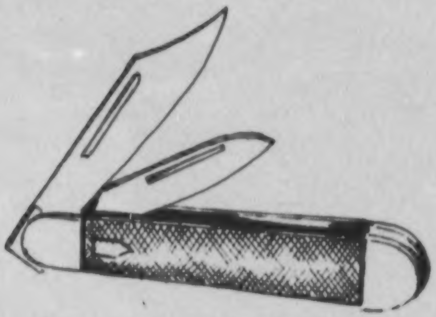
In this lesson you will learn how to splice (connect) electrical wires.

TURN TO NEXT PAGE

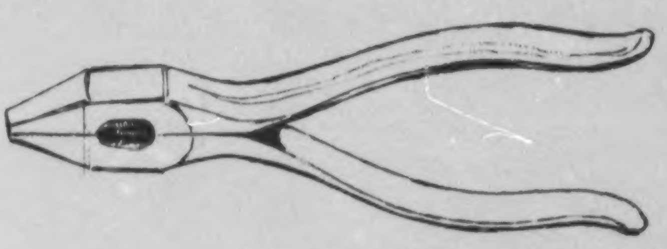
Unit 5
Splicing Electrical Wires

A. Tools, Materials and Equipment for Splicing Electrical Wires.

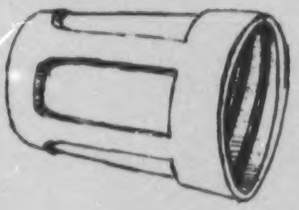
1. **POCKET KNIFE:** Used to remove insulation from electrical wire.



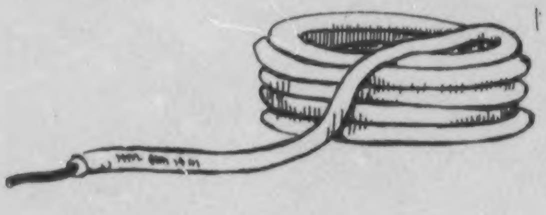
2. **SIDE-CUTTING PLIERS:** Used to cut and twist electrical wiring.



3. **WIRE NUT:** Used to hold bare electrical wires together.

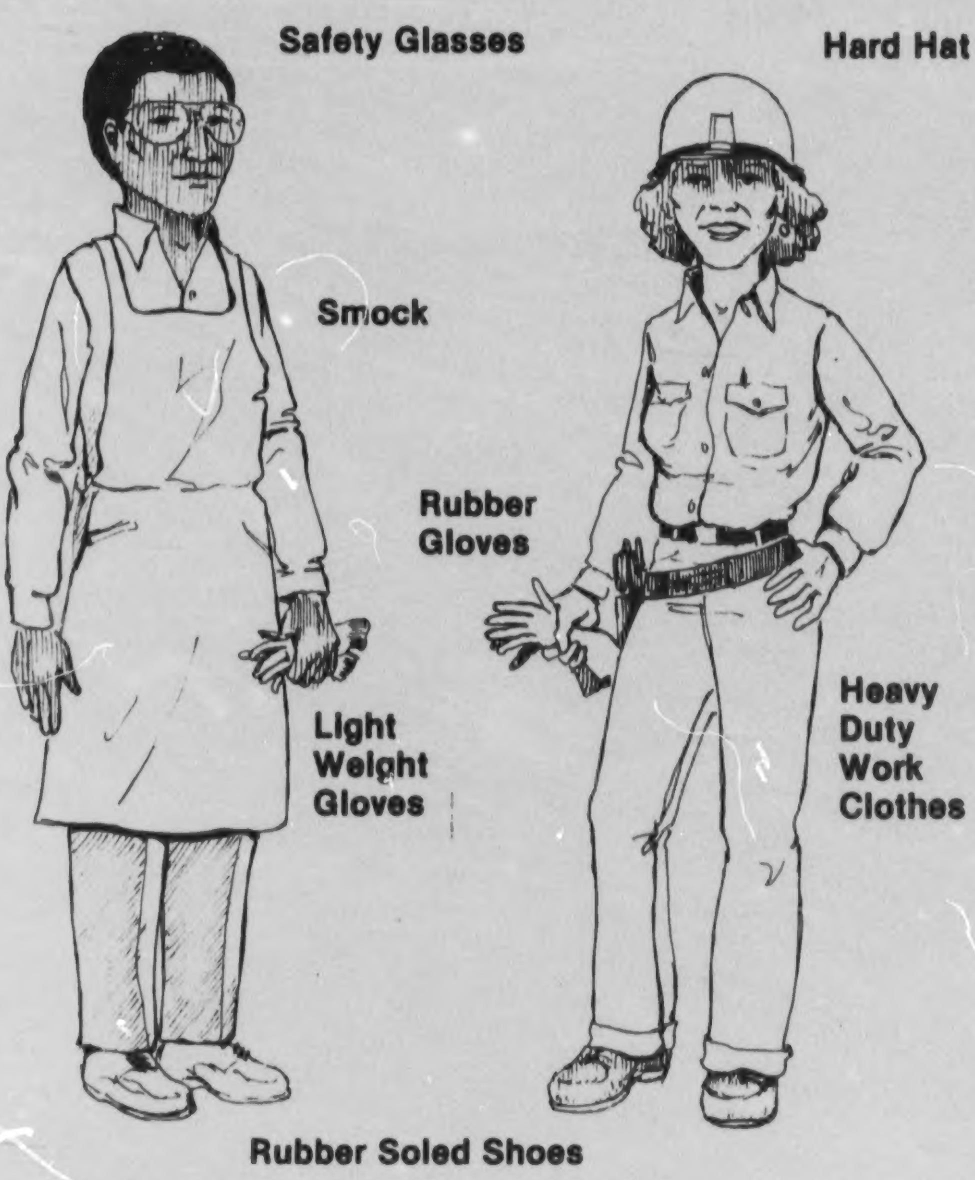


4. **ELECTRICAL WIRE:** Insulated wire which conducts electricity.



Electrical Wiring Safety Equipment

Different electrical jobs will require different safety equipment.


Safety Glasses
Hard Hat
Smock
Rubber Gloves
Light Weight Gloves
Heavy Duty Work Clothes
Rubber Soled Shoes

Indoor Safety Equipment **Outdoor Safety Equipment**

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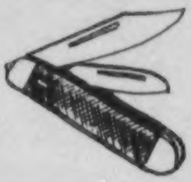
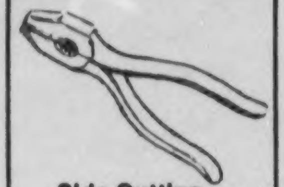
B. Steps in Making a Pigtail Splice:

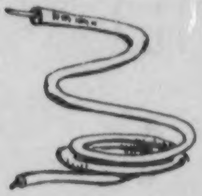
1. Find and Check Off the following.



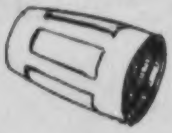
☐ Knife



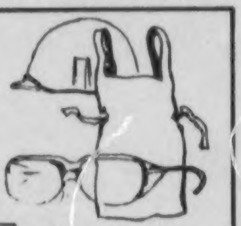
☐ Side-Cutting Pliers



☐ Electrical Wire

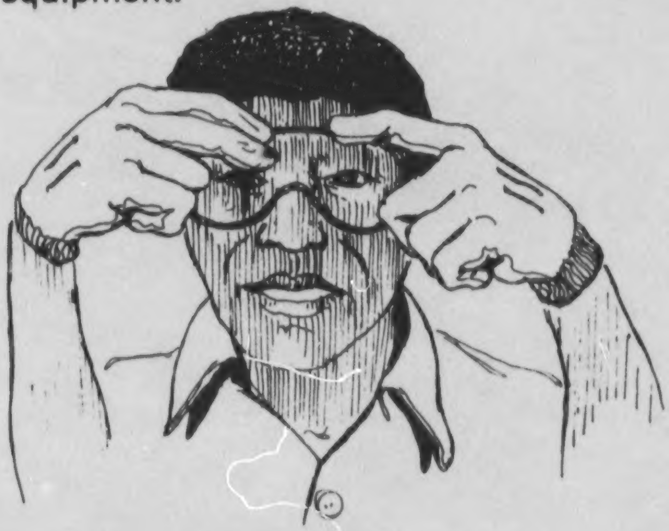


☐ Wire Nut

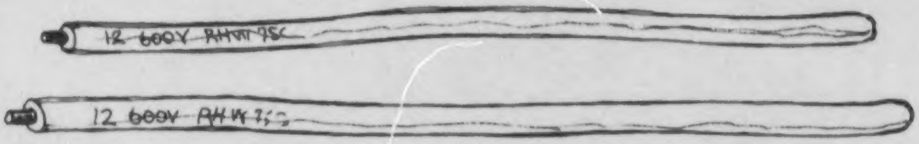


☐ Safety Equipment

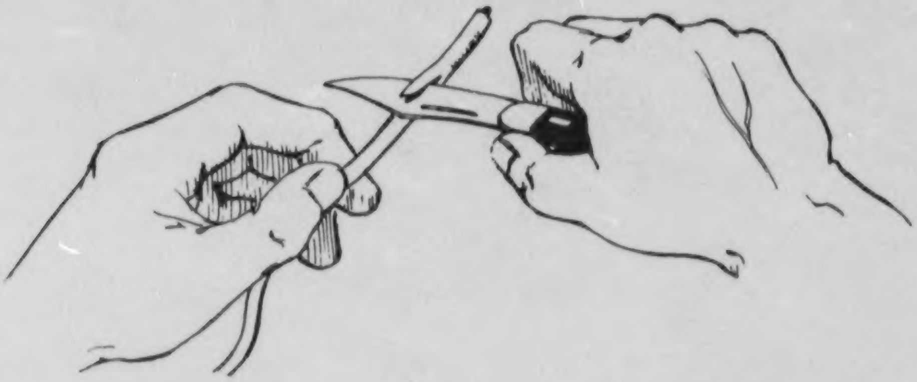
2. Put on proper safety equipment.



3. Obtain two pieces of number 12 or number 14 electrical wire.


12 600V RHW 75C
12 600V RHW 75

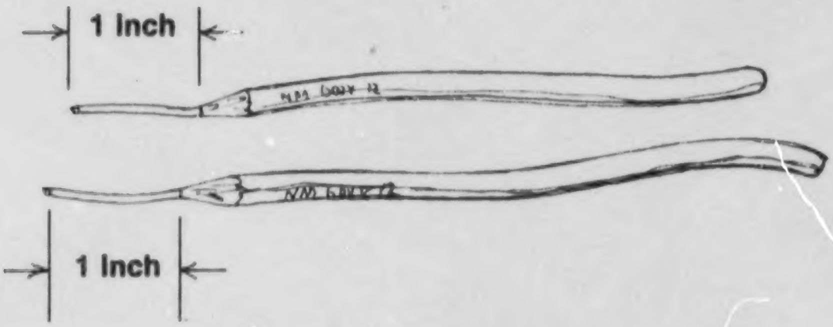
4. Cut the insulation from the wire. Hold the knife and cut like you would sharpen a pencil. Cut about one inch from the end.



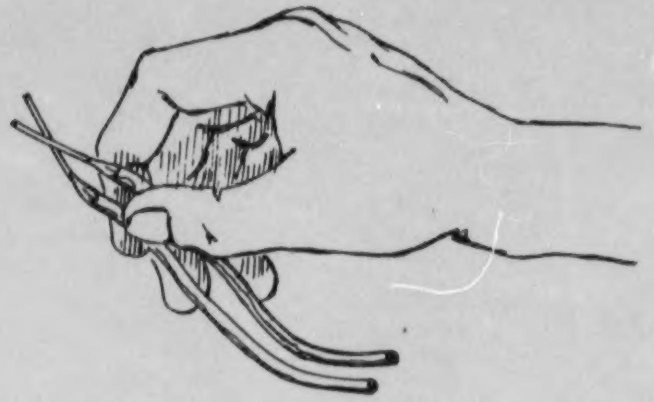
CAUTION!

Always cut away from yourself and others. The knife is sharp and can cause injury if you are not careful.

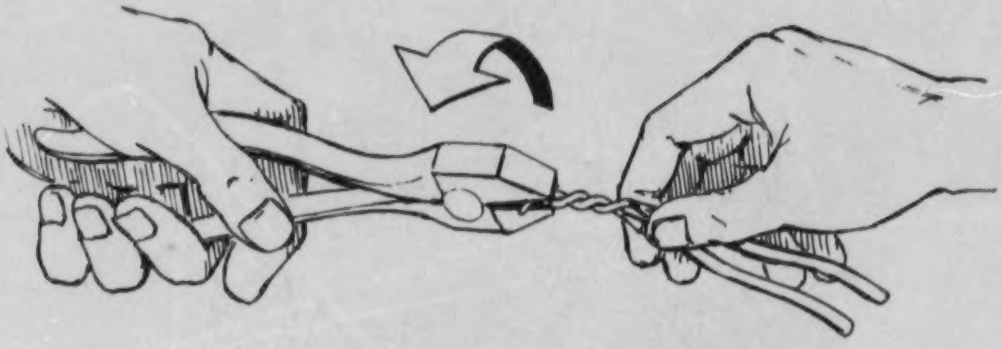
5. Cut the other wire the same way.



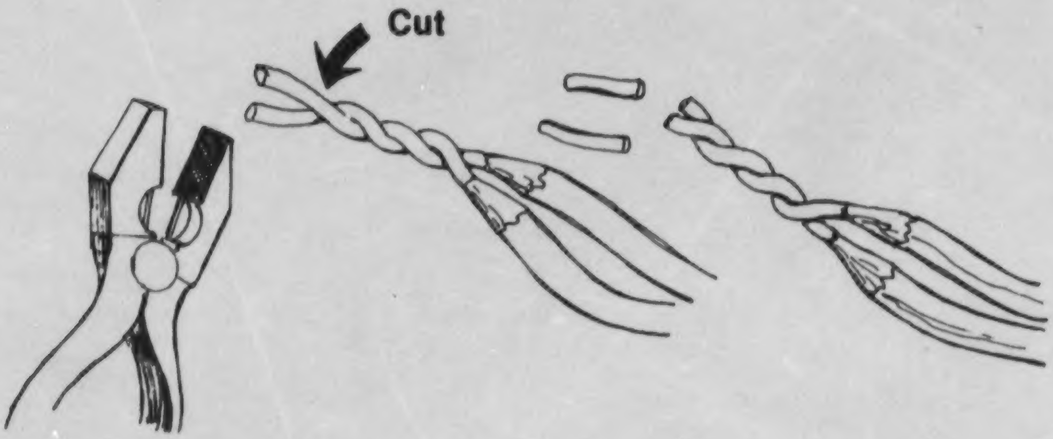
6. Cross the wires and hold them with thumb and finger.



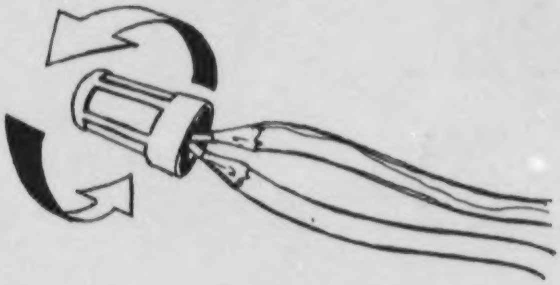
7. Clamp wires near the end. Twist them two or three turns with the pliers.



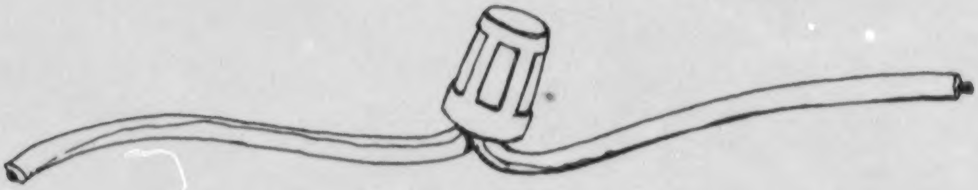
8. Cut off excess wire with the pliers.



9. Slip the twisted wires into the wire nut. Turn the wire nut to the right until the wire nut is tight.



10. Practice splicing with other sizes and lengths of wire.



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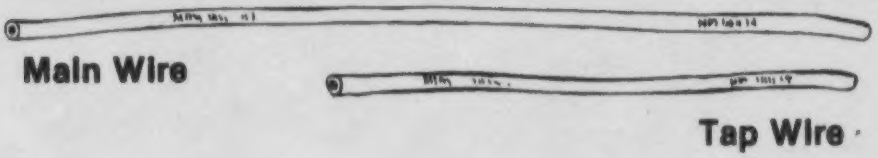
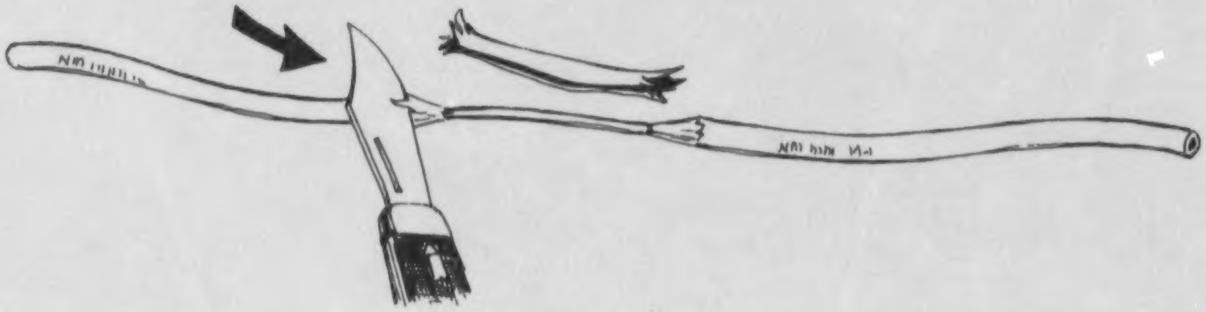
C. Steps in Making a Tap Splice

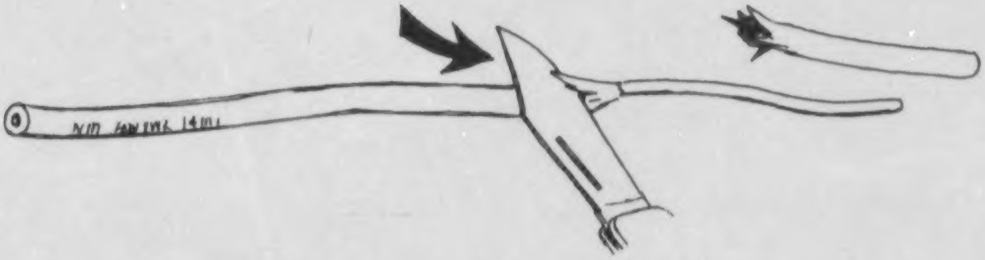
1. Obtain two pieces of number 12 or number 14 wire. The main wire is 20 inches long. The tap wire is 12 inches long.



2. Remove 1¼ inches of insulation from the middle of the 20 inch main wire.



3. Remove about 2 inches of insulation from one end of the 12 inch tap wire.

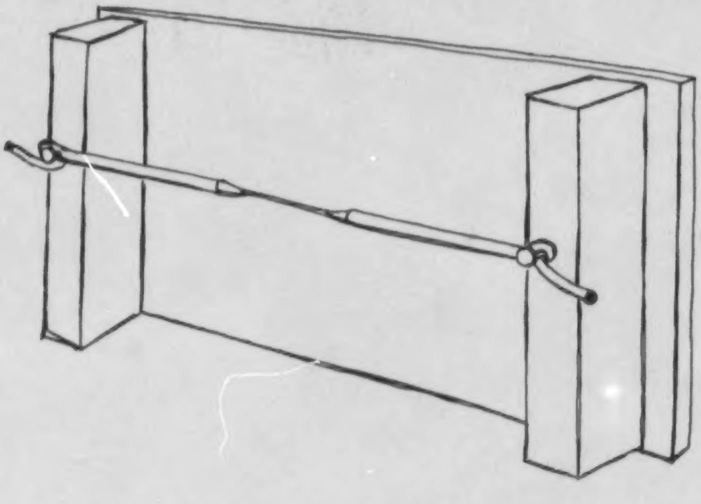


CAUTION!

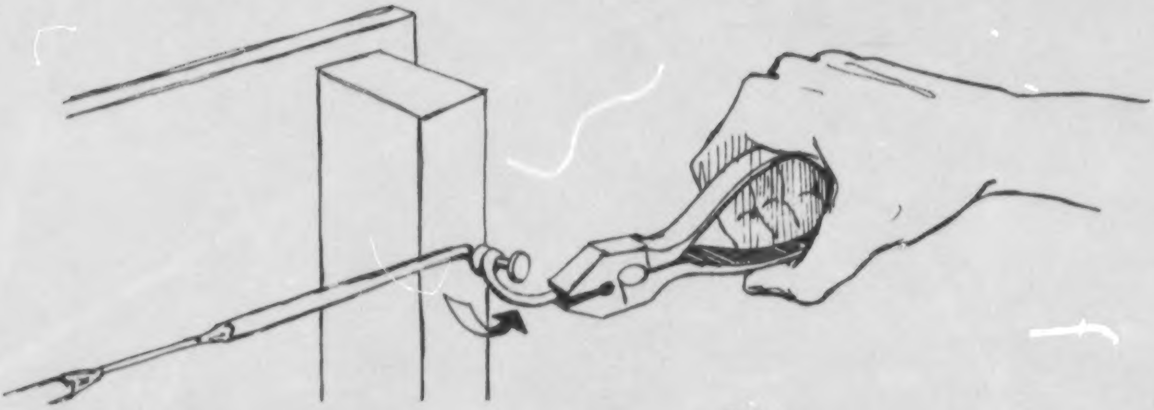
Always point the knife away from yourself and others.

Handle bare wire carefully because it has sharp points that can injure you.

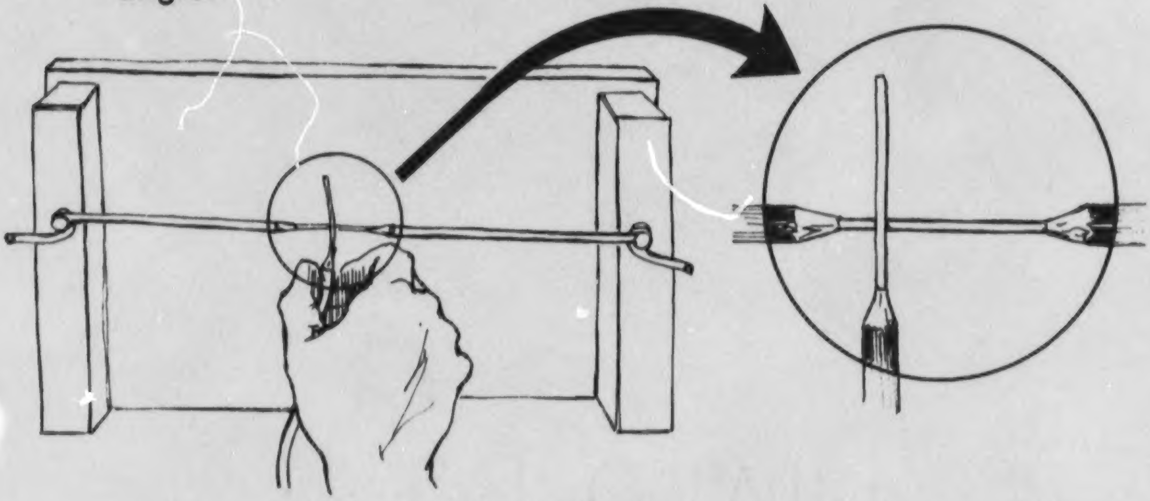
4. Stretch the main wire across a frame support to secure it for splicing.



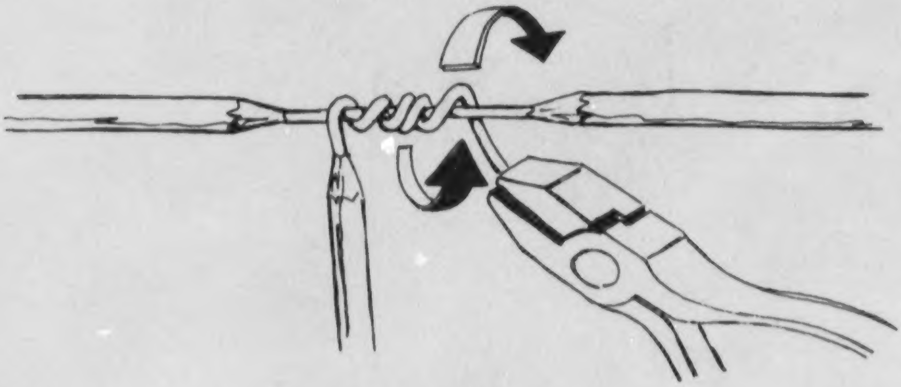
5. Use pliers to tighten the wire on both ends.



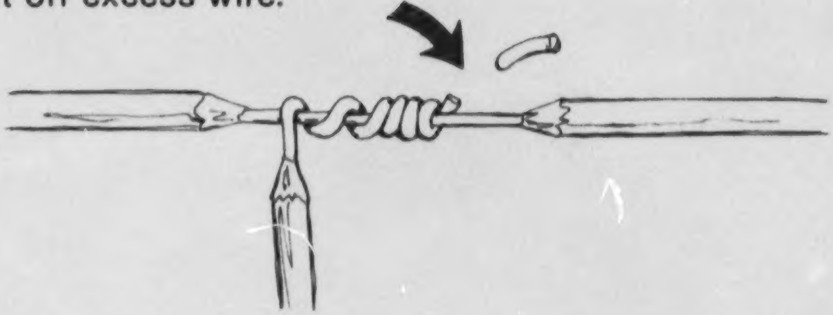
6. Place the 12 inch tap wire across the main wire at a right angle.



7. Twist the 12 inch tap wire tightly around the main wire.



8. Cut off excess wire.



9. Practice this splicing method using different sizes of wire.

10. Clean your work area and return tools to their proper places.

SEE YOUR INSTRUCTOR

Unit 5
Splicing Electrical Wires

Practical Exercise Performance Checklist

The student ____________________ successfully performed the following tasks:

Tasks	Yes	No	Comments
Pigtail Splice 1. Wore proper safety equipment.			
2. Removed insulation from wires safely and correctly.			
3. Crossed and held wires correctly for splicing.			
4. Twisted the wires correctly.			
5. Cut excess wires correctly.			
6. Secured the splice with wire nut.			
7. Cleaned work area and returned tools to their proper places.			
Tap Splice 1. Obtained main and tap wires.			
2. Removed insulation from the wires safely and correctly.			
3. Stretched and secured main wire across frame support.			
4. Correctly placed and twisted the tap wire to the main wire.			
5. Cut off excess tap wire.			
6. Cleaned work area and returned tools to their proper places.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

____________________ Instructor's Signature

__________ Date

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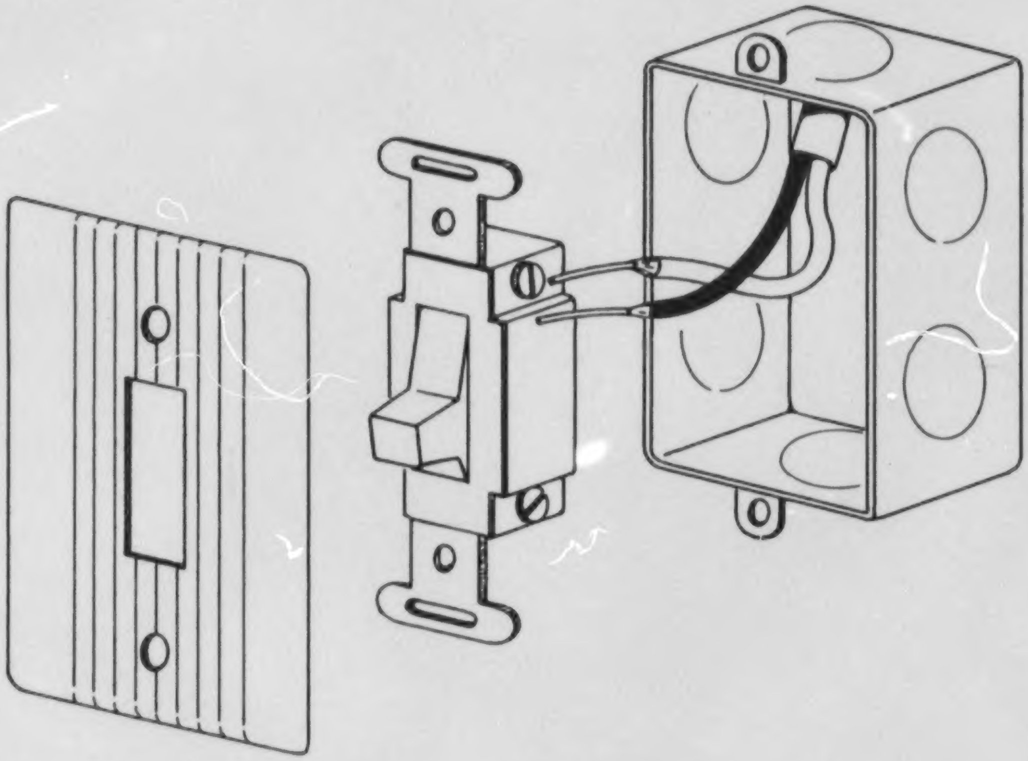
Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 6

Soldering and Taping Electrical Wire Splices

Developed by: Hogan Usoro

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UNIVERSITY OF MISSOURI-COLUMBIA

Unit 6
Soldering and Taping Electrical Wire Splices

Soldering and Taping Electrical Wire Splices

After you study this lesson, you should be able to:

1. Identify tools and materials used to solder electrical wiring splices.
2. Solder and tape a pigtail splice.
3. Solder and tape a tap splice.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

SEE YOUR INSTRUCTOR

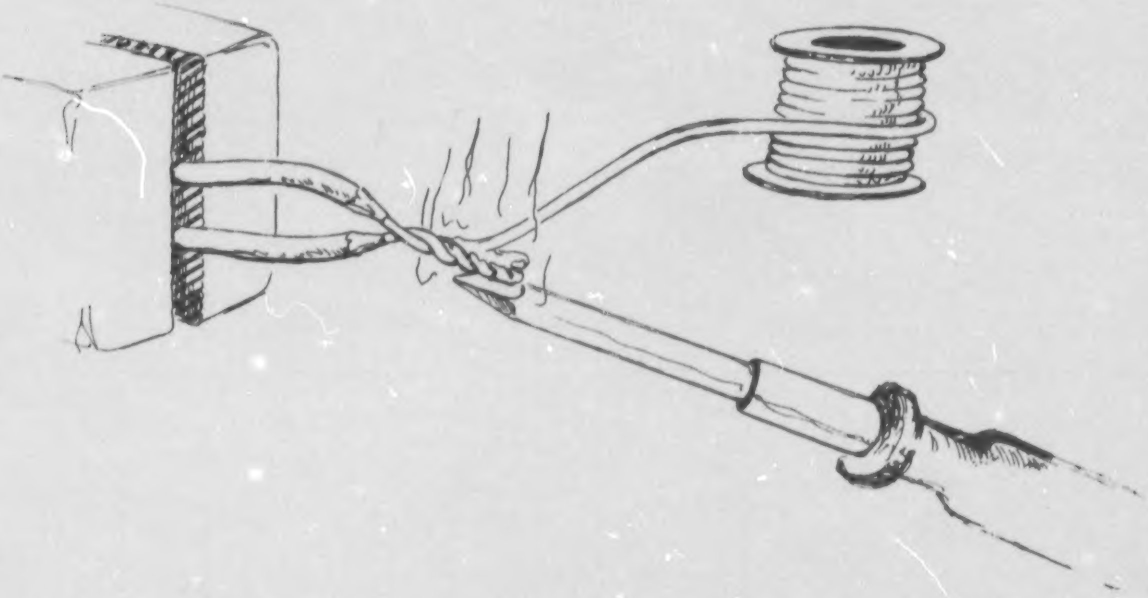
2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

TURN THE PAGE AND BEGIN

Unit 6
Soldering and Taping Electrical Wire Splices

Introduction

In this lesson you will learn how to solder splices. Soldering is joining two metal wires together by melting a third metal onto the joint. This third metal is called solder. You will use a soldering iron to provide heat for melting.



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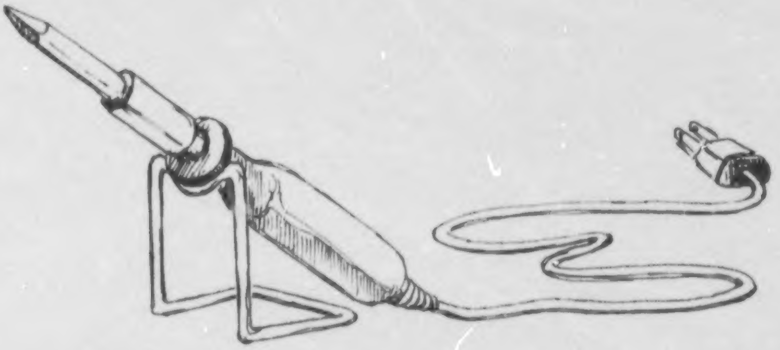
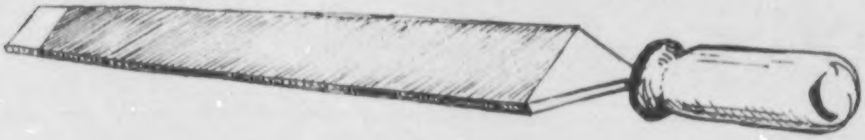
Unit 6
Soldering and Taping Electrical Wire Splices

A. Tools, Materials and Equipment for Soldering and Taping Electrical Wire Splices.

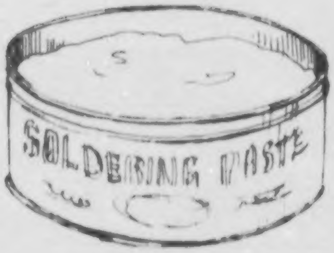
1. **SOLDERING IRON:** Electrical tool used to melt solder.



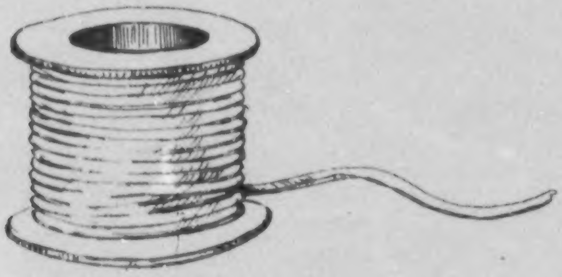
2. **FILE:** Tool used to clean soldering iron tip.



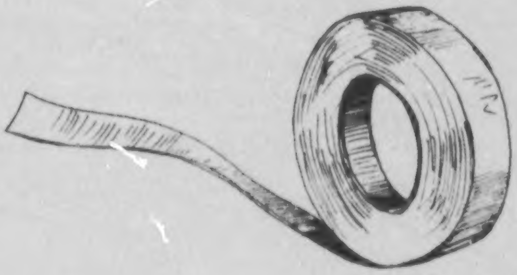
3. **SOLDERING PASTE:** Substance used to clean the soldering iron tip.



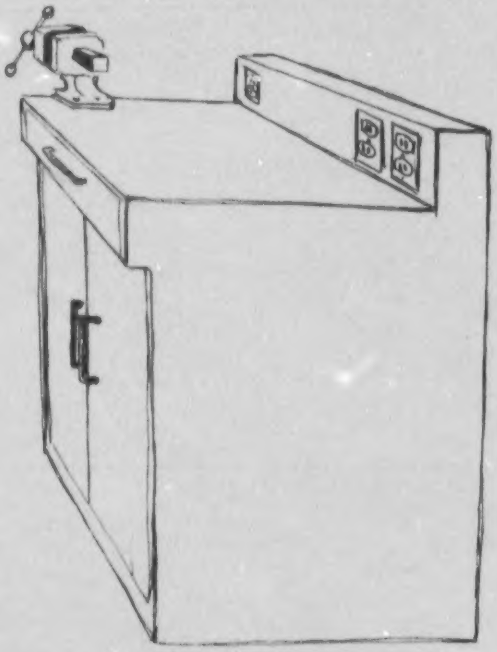
4. **SOLDER:** Metal wire melted onto the wire splice.



5. **ELECTRICAL TAPE:** Used to wrap soldered wire for insulation and protection.



6. **WORK STATION:** Work area where soldering is done.



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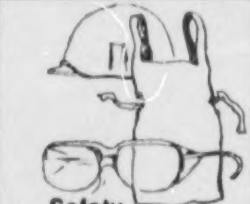
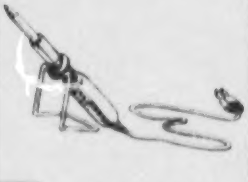
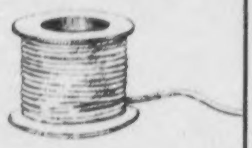
Unit 6
Soldering and Taping Electrical Wire Splices

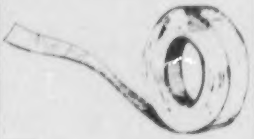
B. Steps in Soldering and Taping a Pigtail and Tap Splice.

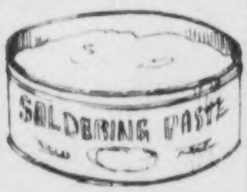
1. Find and Check Off the following.

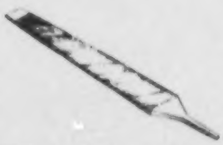

☐ Safety Equipment

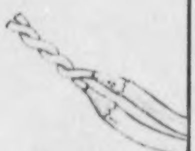

☐ Soldering Iron

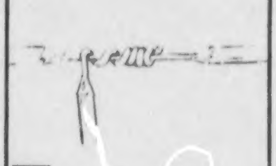

☐ Solder


☐ Tape

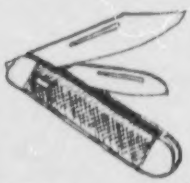

☐ Soldering Paste


☐ File

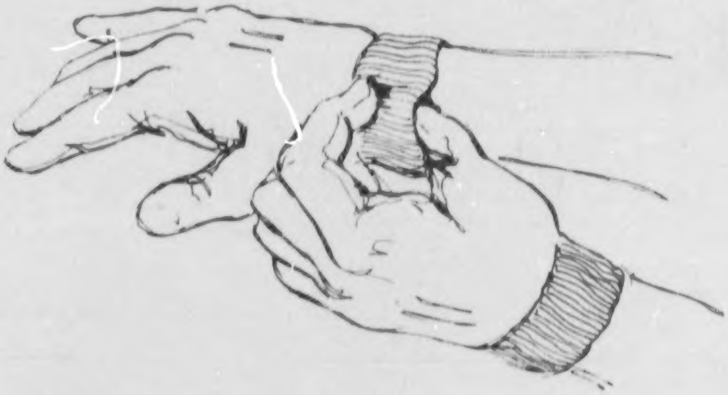

☐ Pigtail Splice


☐ Tap Splice

☐ Work Station

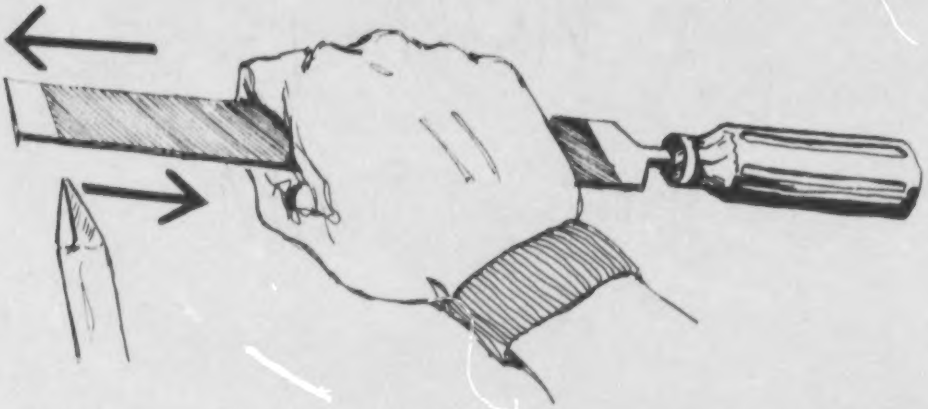

☐ Knife

2. Put on proper safety equipment.



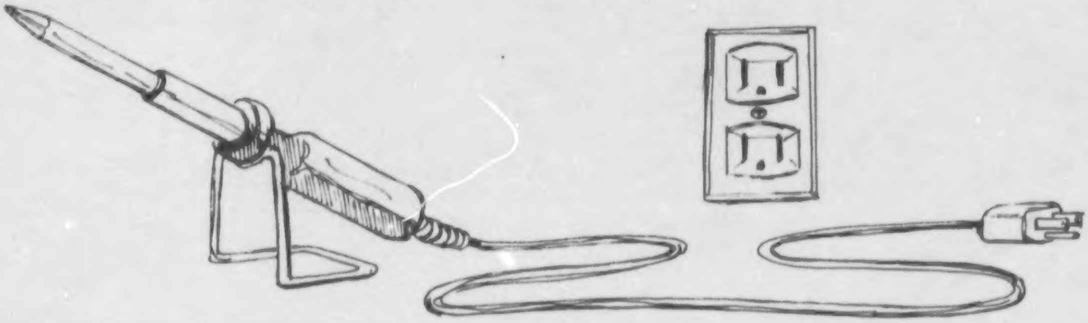
3. File the soldering iron tip until it is clean and bright.

   A clean tip is necessary for good soldering.

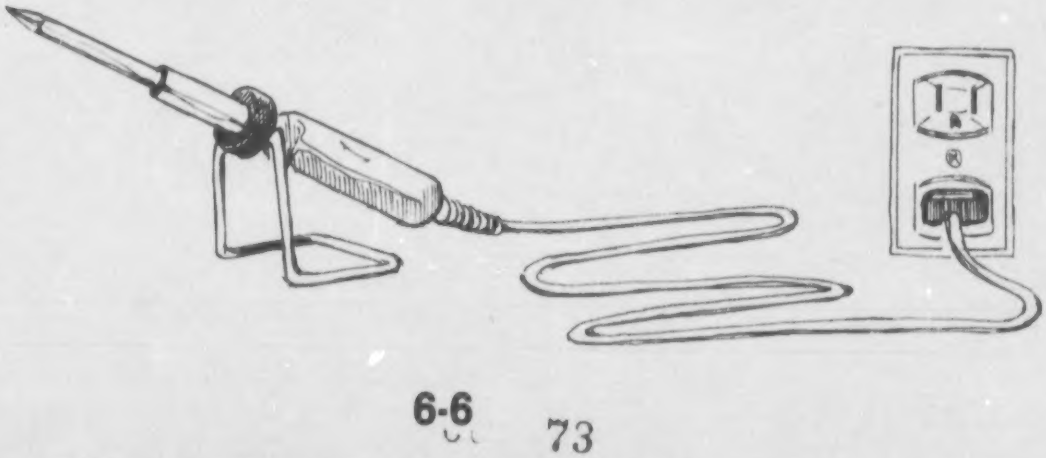


CAUTION!

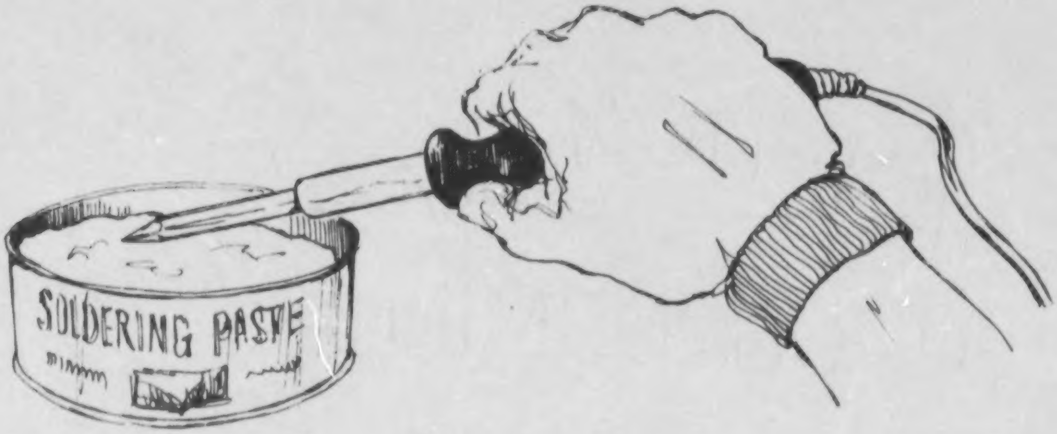
Never connect the soldering iron to power outlet while cleaning the tip because you can get burned or shocked.



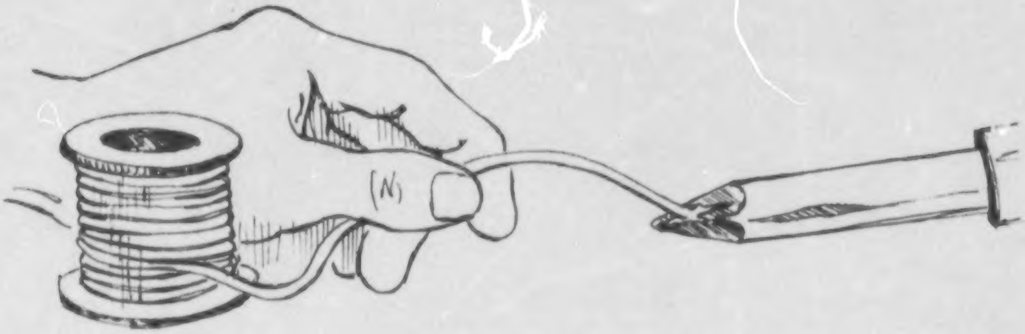
4. Connect the soldering iron to an electrical outlet. Allow it to heat up.



5. Dip the soldering iron into the soldering paste.



6. Apply solder to the tip of the soldering iron.

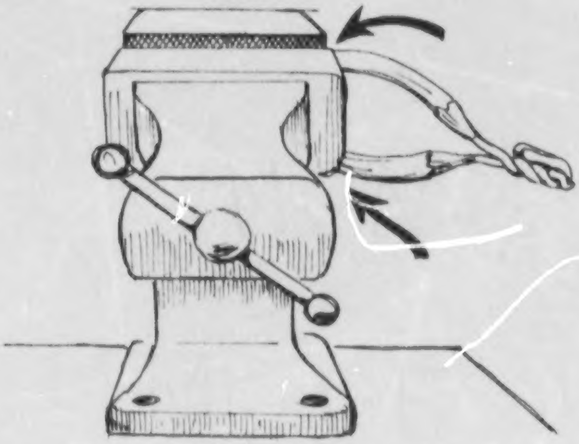


If the soldering iron is hot, the solder melts and flows smoothly around the tip.

TURN TO NEXT PAGE

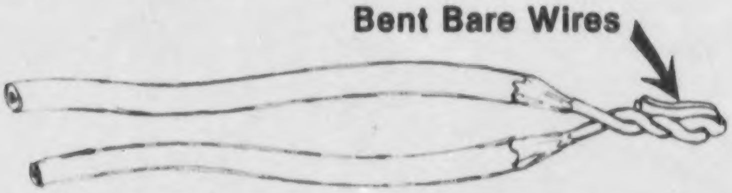
C. Steps to Solder and Tape the Pigtail Splice.

7. Obtain or make a pigtail splice and secure it in a vise.

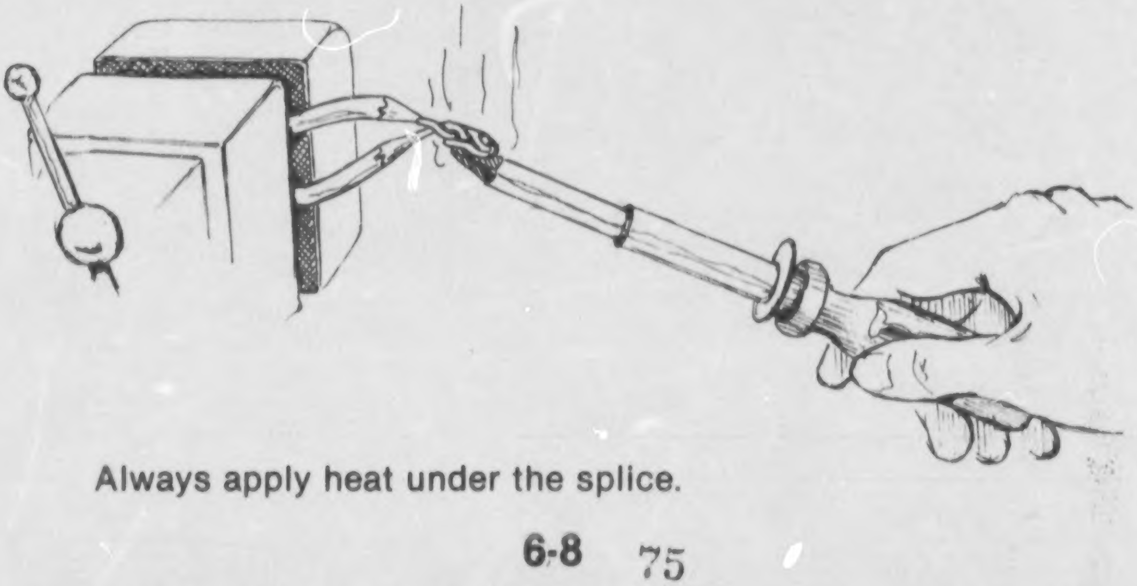


NOTE!

When soldering a splice the excess bare wire should be bent over the splice and not cut off.

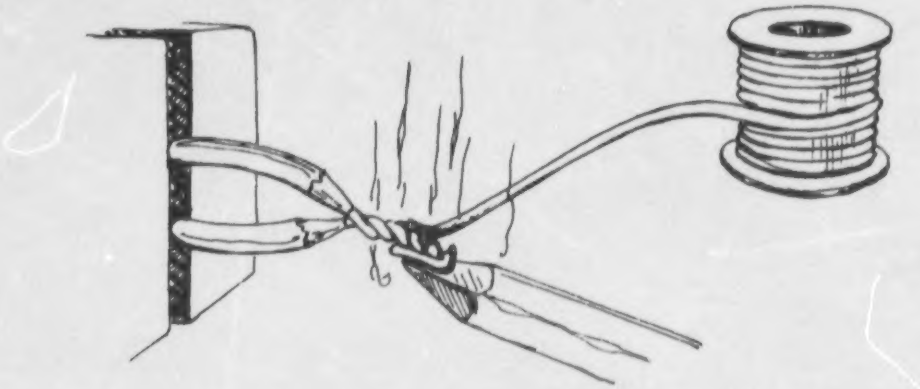


8. Heat the pigtail splice with the tip of the soldering iron.



Always apply heat under the splice.

9. Apply the solder to the splice.

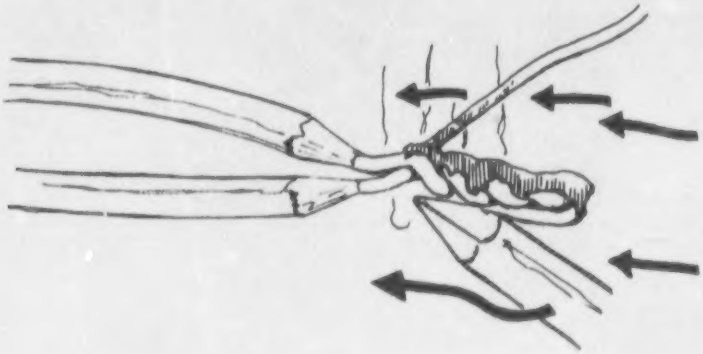


NOTE!

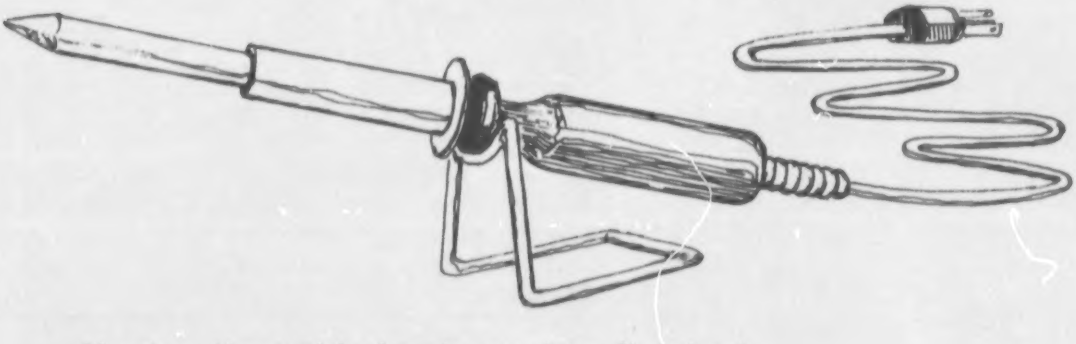
Always apply solder above the splice.

Always apply heat below the splice.

10. Melt solder smoothly over the entire splice.



11. Remove solder and place soldering iron on its support.



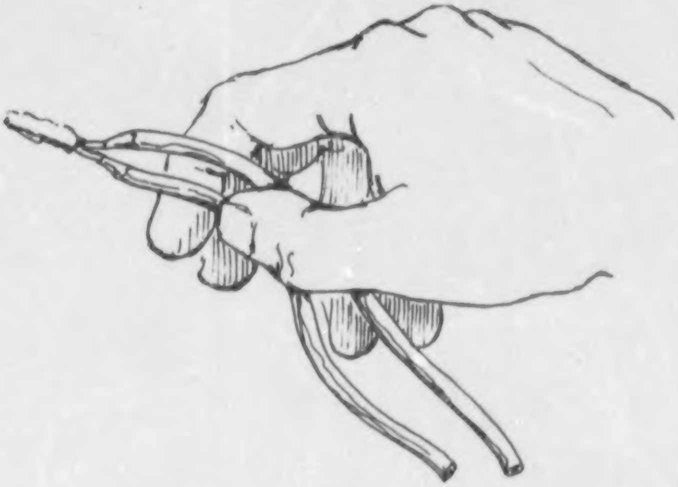
Unplug the soldering iron when finished.

NOTE!

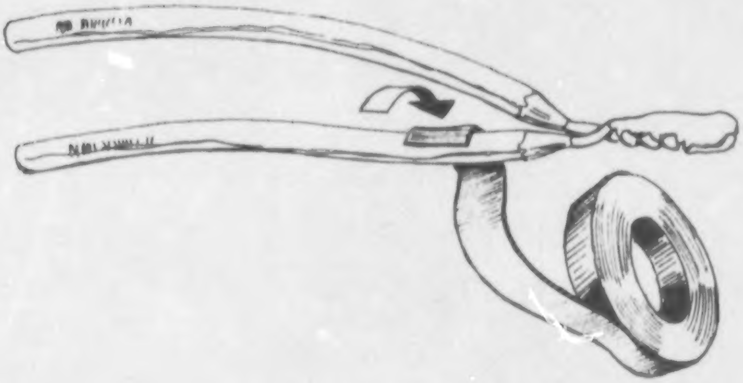
Do not move the soldered splice until the silvery colored solder turns dull white.

Dull white shows the solder has cooled and hardened.

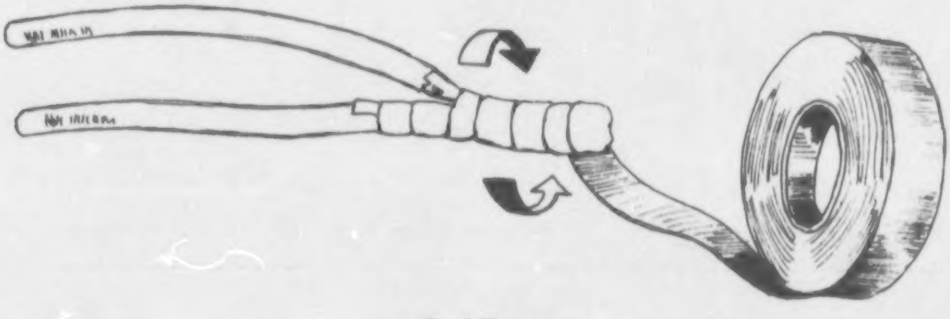
12. Remove the soldered splice from the vise.



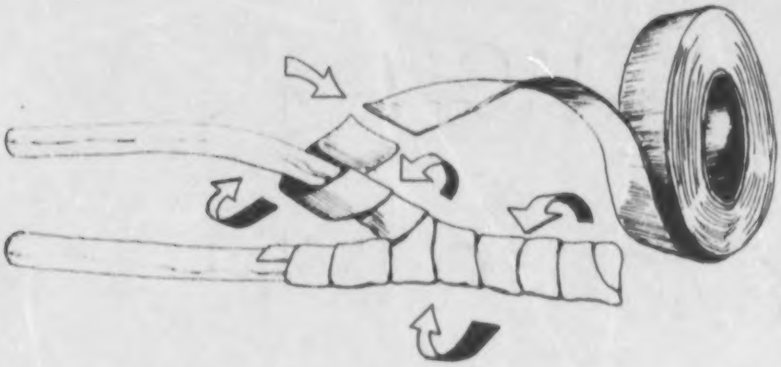
13. Begin taping the soldered splice with the electrical tape.



14. Tape toward the pigtail. Double tape at the tail.



15. Tape back in the direction from which you started.

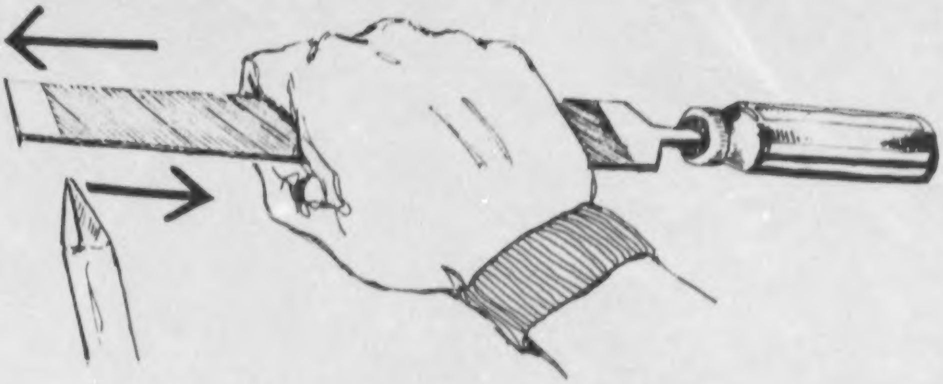


Cut the tape with the knife.

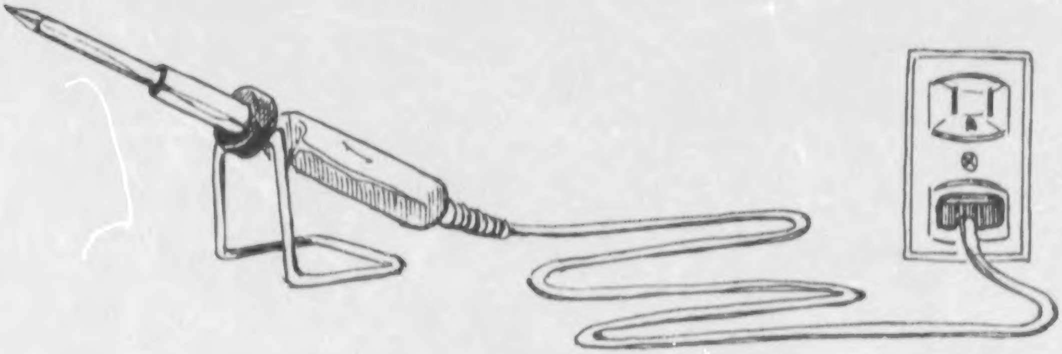
TURN TO NEXT PAGE

D. Steps to Solder and Tape the Tap Splice.

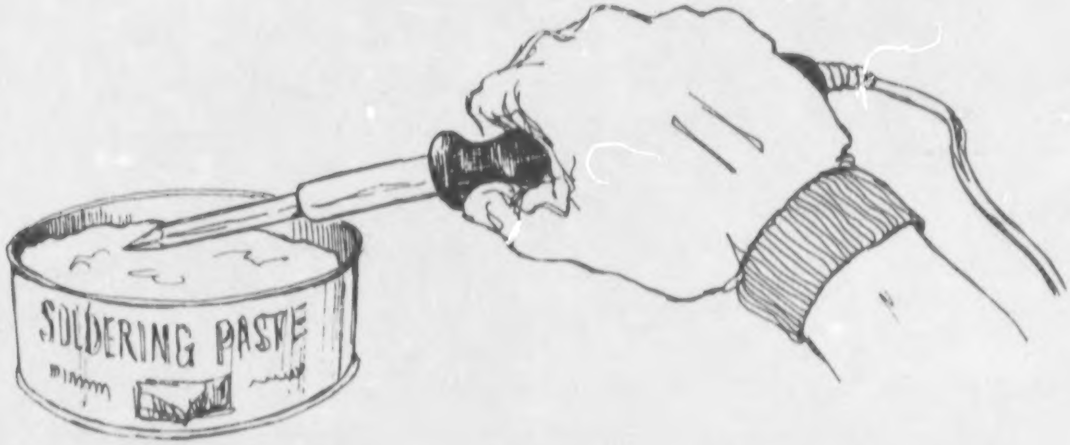
16. File the soldering iron tip.



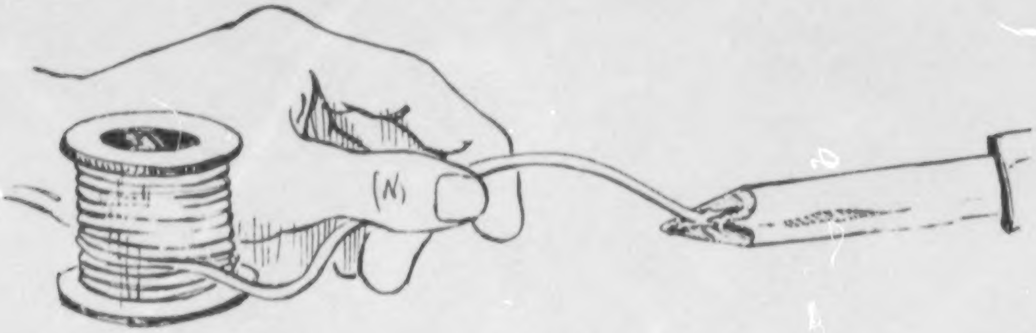
17. Connect the soldering iron to the power source and let it heat up.



18. Dip the soldering iron into the soldering paste.



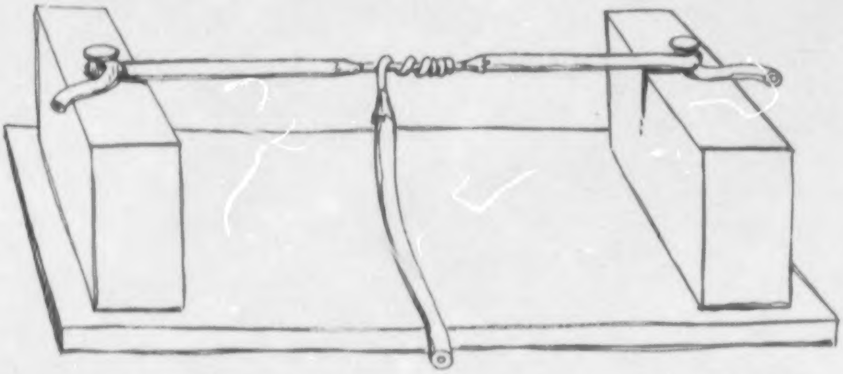
19. Apply solder to the tip of the soldering iron.



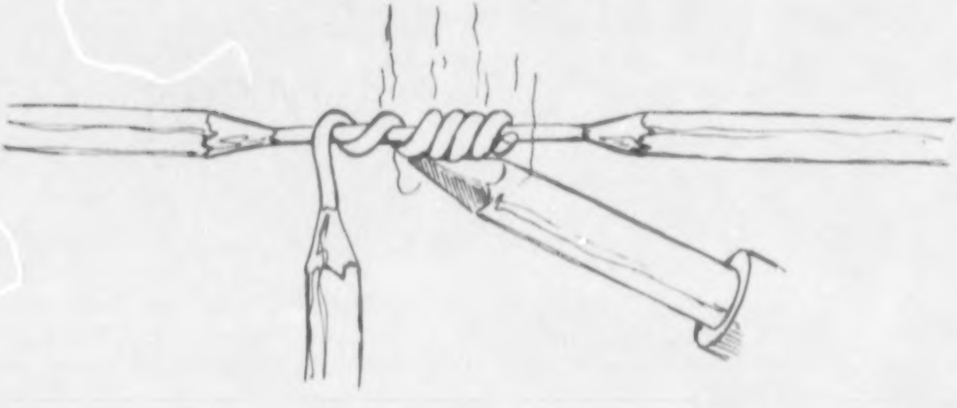
NOTE!

When soldering a splice the excess bare wire should be bent over the splice and not cut off.

20. Obtain or make a tap splice. Secure it to a frame support.



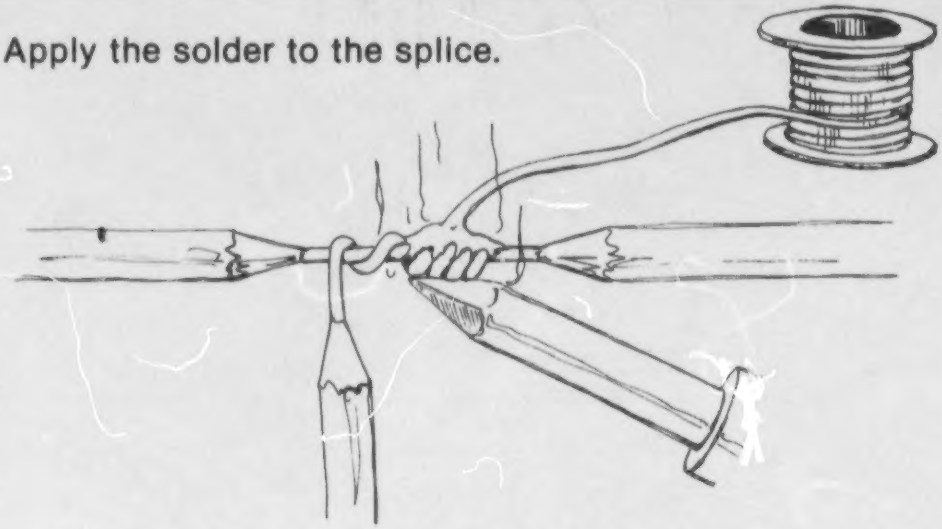
21. Heat the tap splice with the soldering iron.



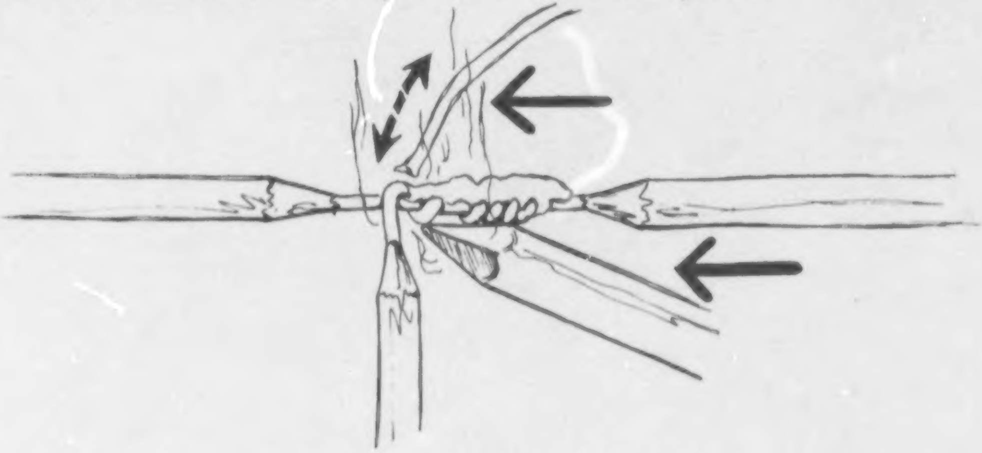
NOTE!

Always apply heat under the splice.
Always apply solder above the splice.

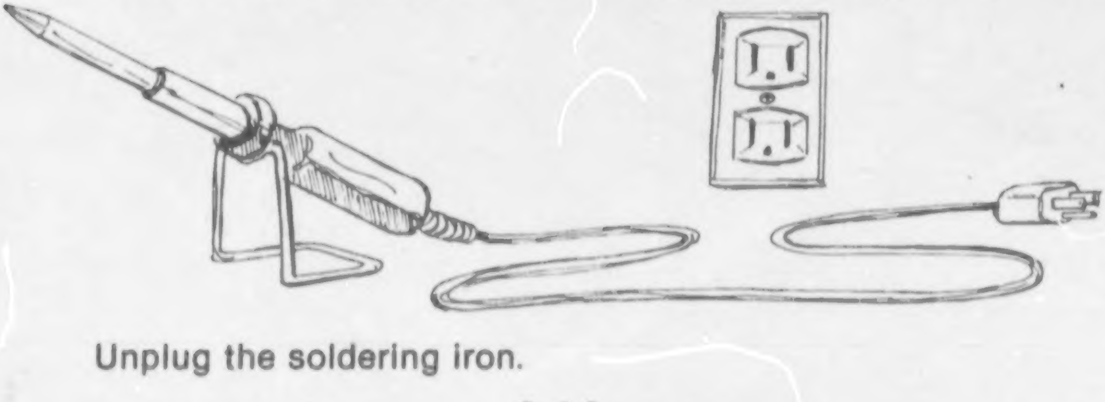
22. Apply the solder to the splice.



23. Melt the solder smoothly over the entire splice.



24. Remove solder and place soldering iron in its support.

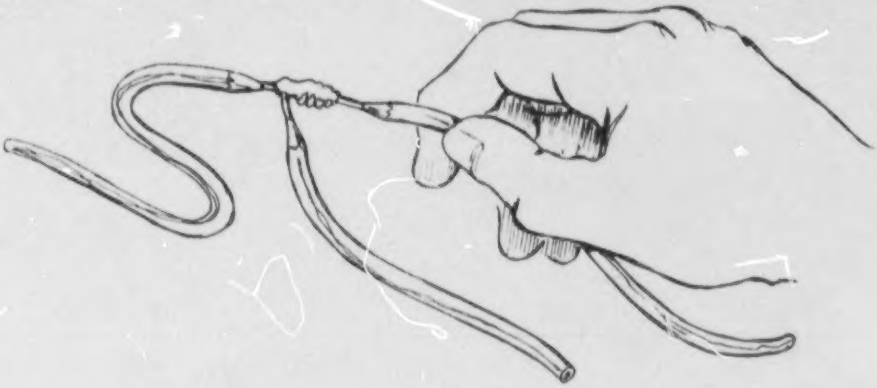


Unplug the soldering iron.

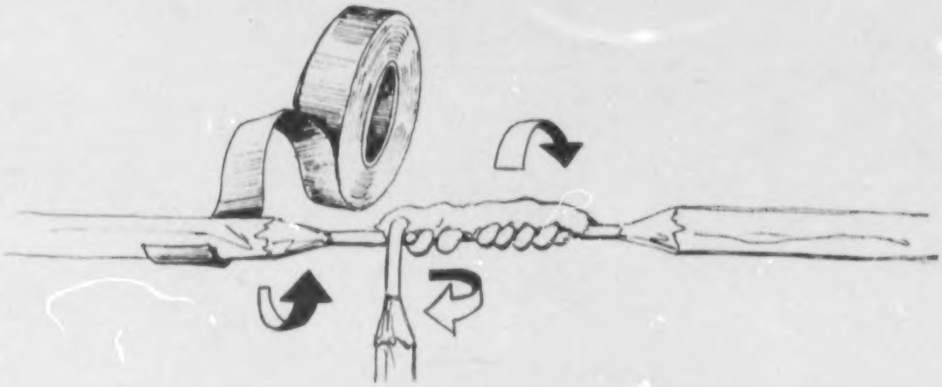
NOTE!

Do not remove the soldered splice until the silvery colored solder turns dull white.
Dull white means the solder has cooled and hardened.

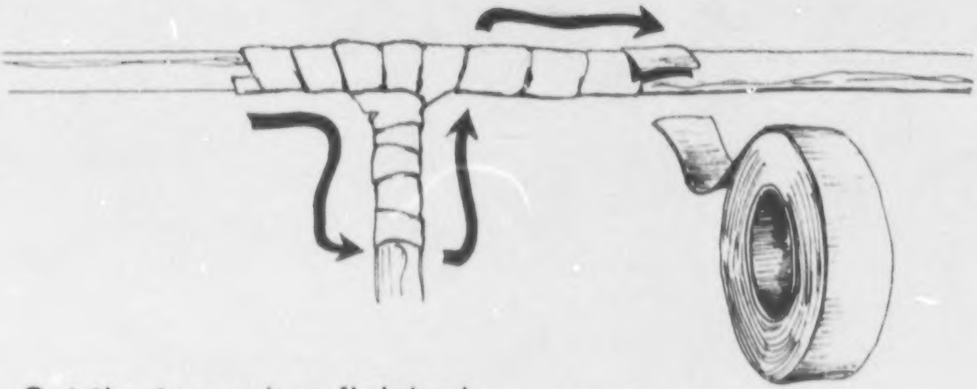
25. Remove the soldered splice from its support.



26. Begin to tape the soldered splice.

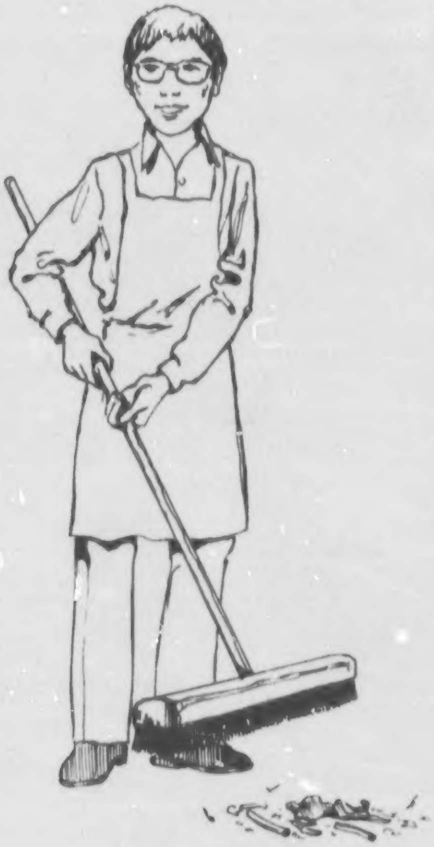


27. Cover all of the bare wires with the tape.



Cut the tape when finished.

28. Clean up your work station and return tools and materials to their proper places.



SEE YOUR INSTRUCTOR

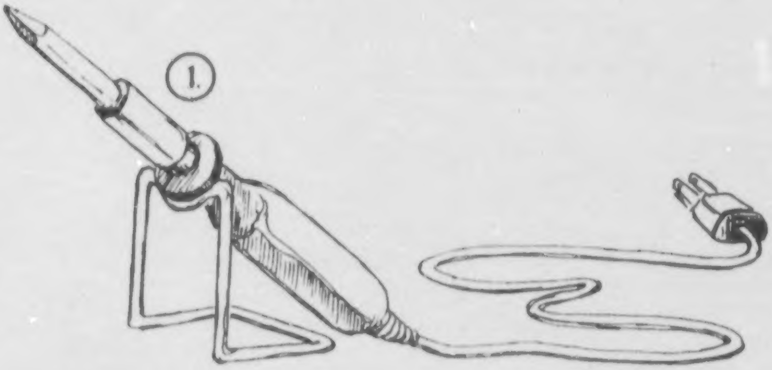
Unit 6
Soldering and Taping Electrical Wire Splices

Tools and Materials Identification Exercise

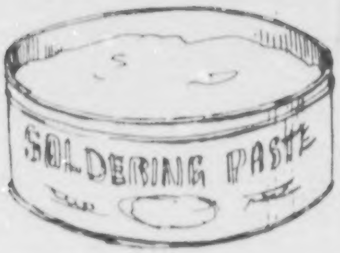
Match each object with its correct name.

_______ A. Soldering Iron
_______ B. Solder
_______ C. Soldering Paste
_______ D. Electrical Tape

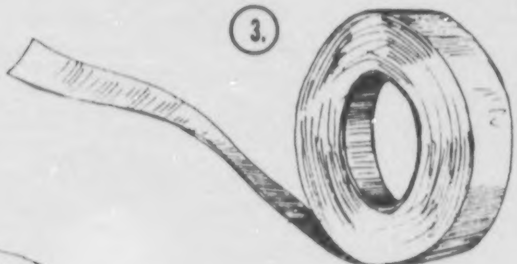
1.



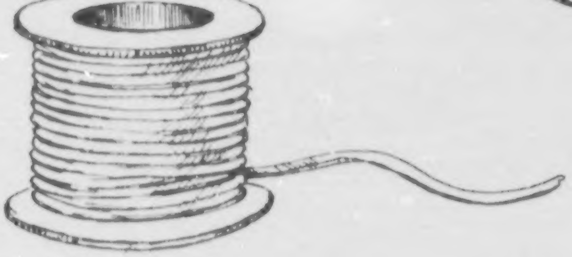
2.



3.



4.



Unit 6
Soldering and Taping Electrical Wires Splices

Practical Exercise Performance Checklist

The student ____________________ successfully performed the following tasks:

Tasks	No	Yes	Comments
Soldering and Taping Pigtail Splice			
1. Identified:			
a. Soldering iron			
b. Solder			
c. Soldering paste			
d. Electrical tape			
e. Soldering iron support			
2. Wore proper safety equipment.			
3. Cleaned the soldering iron tip safely.			
4. Connected soldering iron tip to power source and allowed it to heat up.			
5. Chemically cleaned the soldering iron.			
6. Applied solder to the soldering iron tip.			
7. Secured pigtail splice in a vise.			
8. Heated the pigtail splice correctly.			
9. Applied solder correctly to the heated splice.			
10. Soldered the entire splice.			
11. Safely unplugged soldering iron after soldering.			
12. Allowed soldered splice to cool before removing it from the vise.			
13. Taped the soldered splice correctly.			
14. Neatly trimmed off excess tape.			

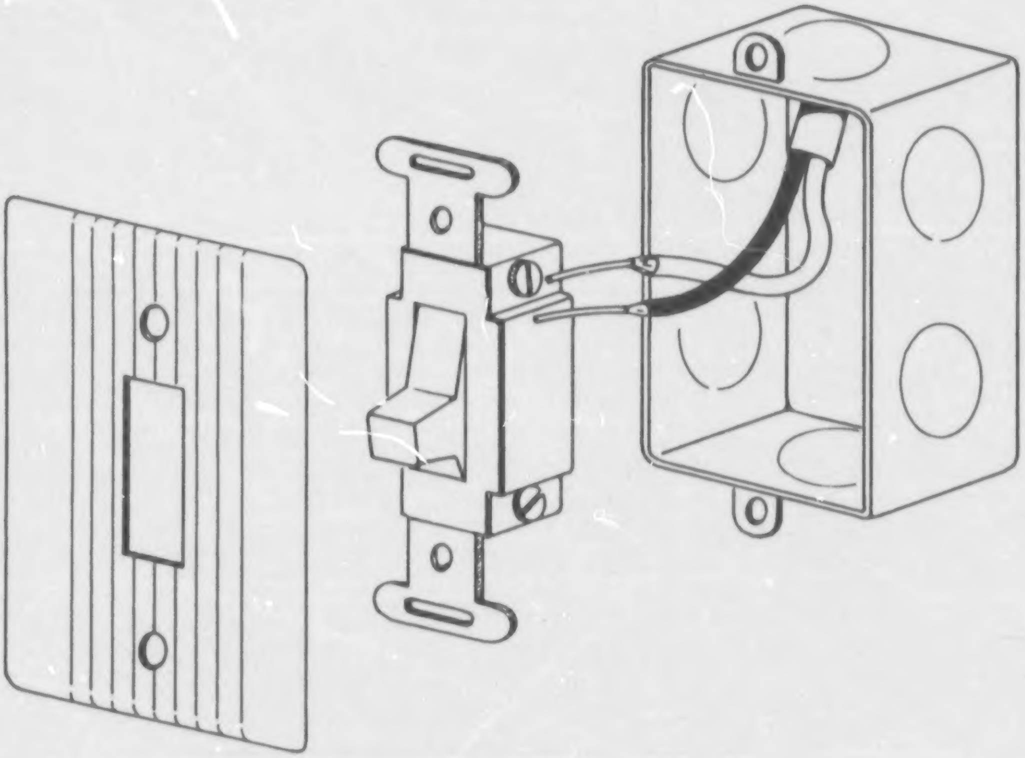
Tasks	No	Yes	Comments
Soldering and Taping Tap Splice.			
15. Filed the soldering iron tip.			
16. Connected soldering iron to power source and let it heat up.			
17. Chemically cleaned the soldering iron tip.			
18. Applied solder to the soldering iron tip.			
19. Obtained or made a tap splice and secured it to a frame support.			
20. Correctly heated the tap splice.			
21. Applied solder to the splice.			
22. Soldered the entire splice.			
23. Safely handled the hot soldering iron and disconnected it.			
24. Removed the soldered splice after it was cooled.			
25. Taped the soldered splice correctly.			
26. Cleaned the work station and returned tools and materials to their proper places.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

Instructor's Signature

Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 7

Installing a Single-Pole Switch

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION

INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 7
Installing a Single-Pole Switch

Installing a Single-Pole Switch

After you study this lesson, you should be able to:

1. Identify tools and materials used to install switches.
2. Install a single-pole switch.

Show What You Can Do

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

   SEE YOUR INSTRUCTOR

2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

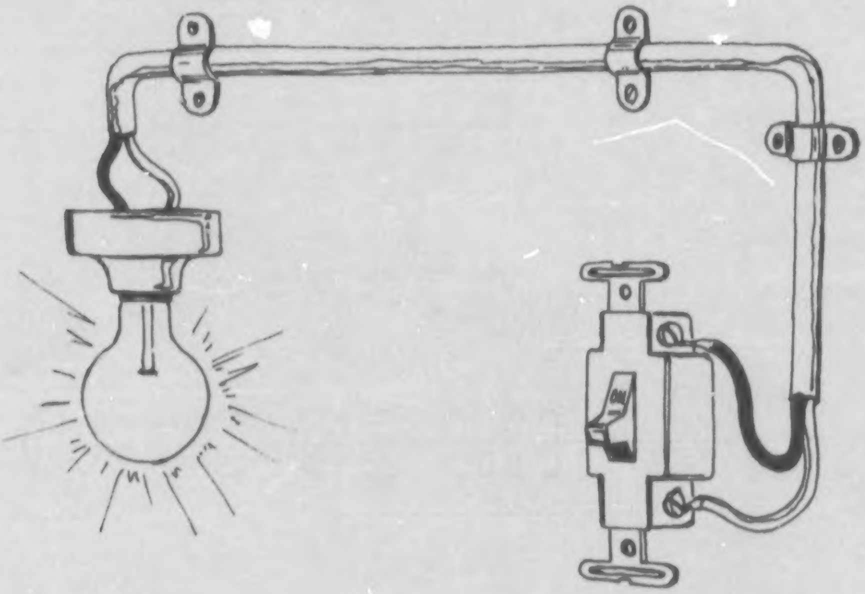
   TURN THE PAGE AND BEGIN

Unit 7

Installing a Single-Pole Switch

Introduction

Electrical wiring includes installing switches. A switch is used to turn lights on and off. You must know how to attach the wires correctly so the switch will work properly.



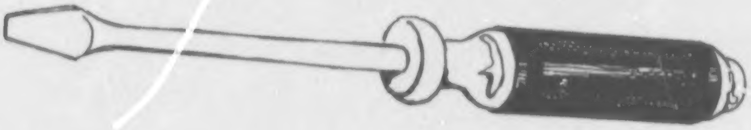
In this lesson you will learn how to install a single-pole or common switch.

TURN TO NEXT PAGE

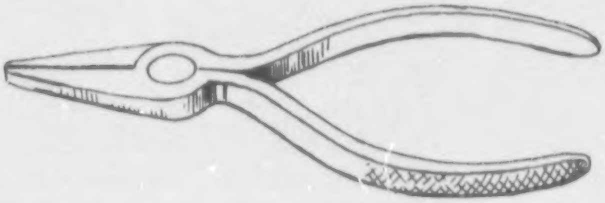
Unit 7
Installing a Single-Pole Switch

A. Tools, Materials and Equipment for Installing a Single-Pole Switch.

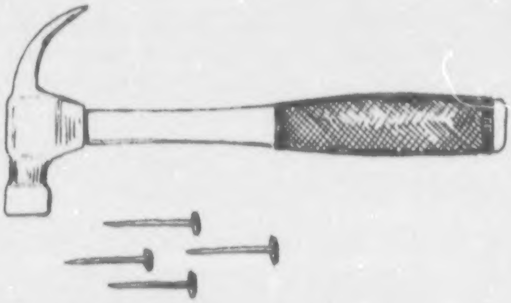
1. **SCREWDRIVER:** Used to tighten and loosen screws.



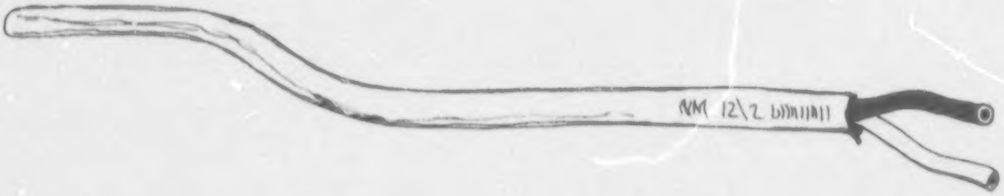
2. **LONG-NOSED PLIERS:** Used to grasp and bend wires.



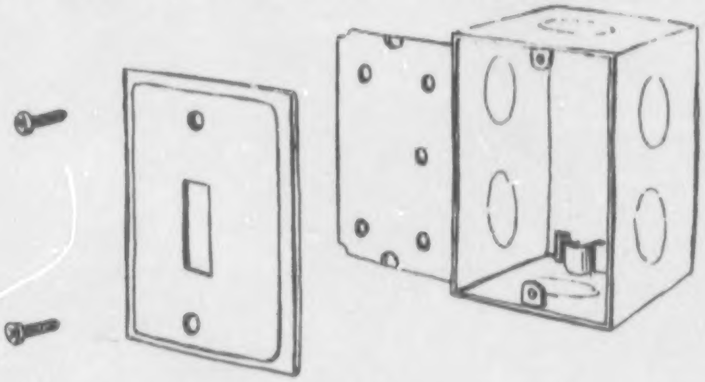
3. **HAMMER AND NAILS:** Used to secure switch box to the wall stud.



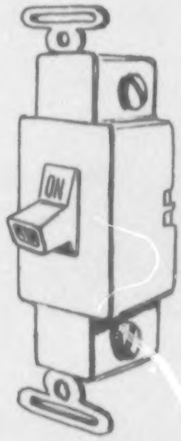
4. **NM 12/2 NON-METALLIC SHEATHED CABLE:** Conducting wire used to carry electrical current.



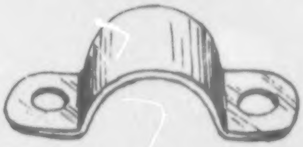
5. **SWITCHBOX AND COVER PLATE:** Used to contain and protect a switch.



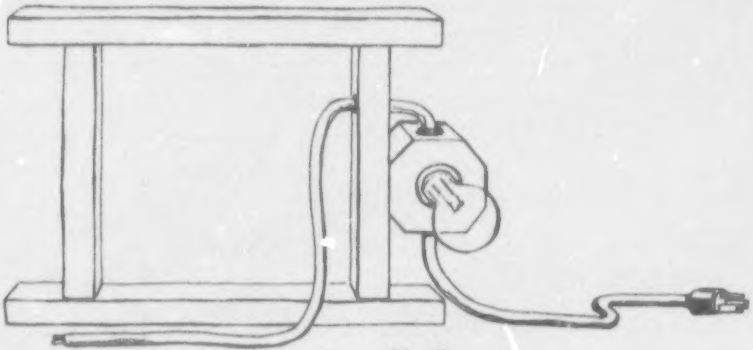
6. **ELECTRICAL SWITCH:** Used to turn flow of electricity on and off.



7. **CABLE STRAPS:** Used to attach cables to wall studs.



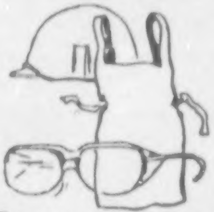
8. **WALL FRAME (With lighting fixture and test plug):** Used to test switch connection.



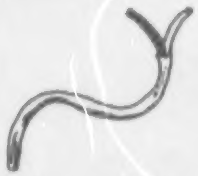
Unit 7
Installing a Single-Pole Switch

B. Steps in Installing a Single-Pole Switch.

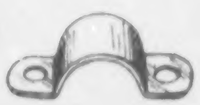
1. Find and Check Off the following.



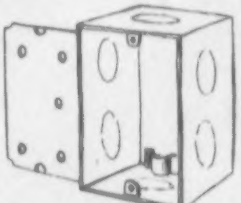
☐ **Safety Equipment**



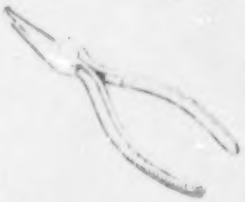
☐ **NM 12/2 Cable**



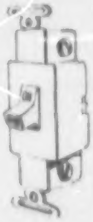
☐ **Cable Strap**



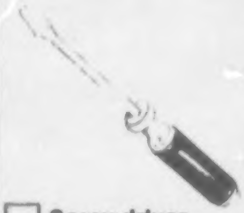
☐ **Switchbox**



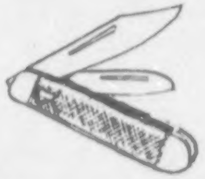
☐ **Long-nosed Pliers**



☐ **Switch**

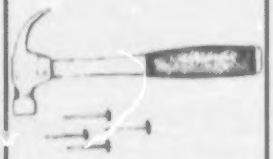


☐ **Screwdriver**



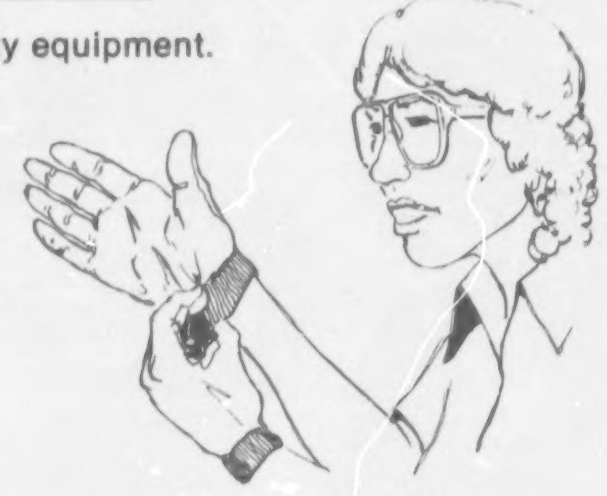
☐ **Pocket Knife**

☐ **Frame & Test plug**

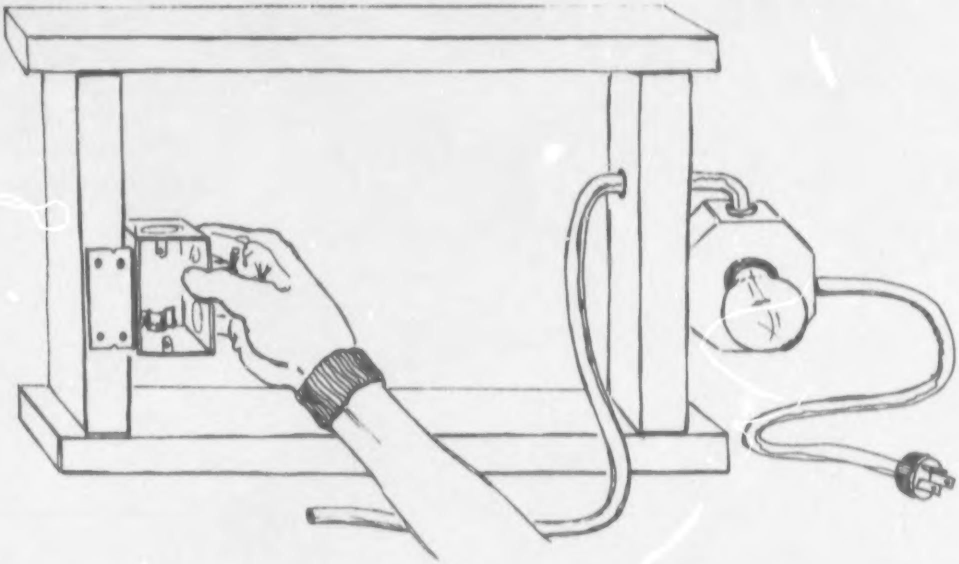


☐ **Hammer & Nails**

2. Put on proper safety equipment.



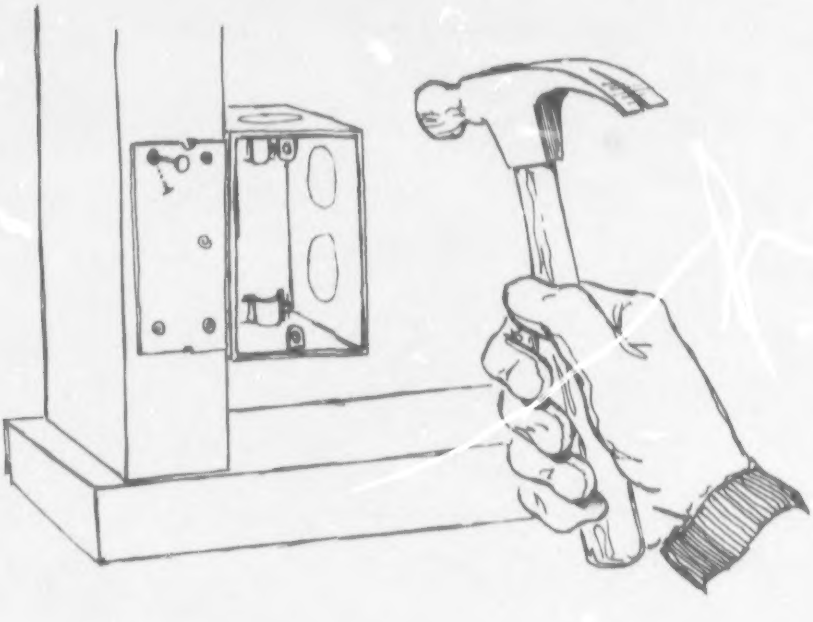
3. Locate and mark position on the wall stud for the switch.



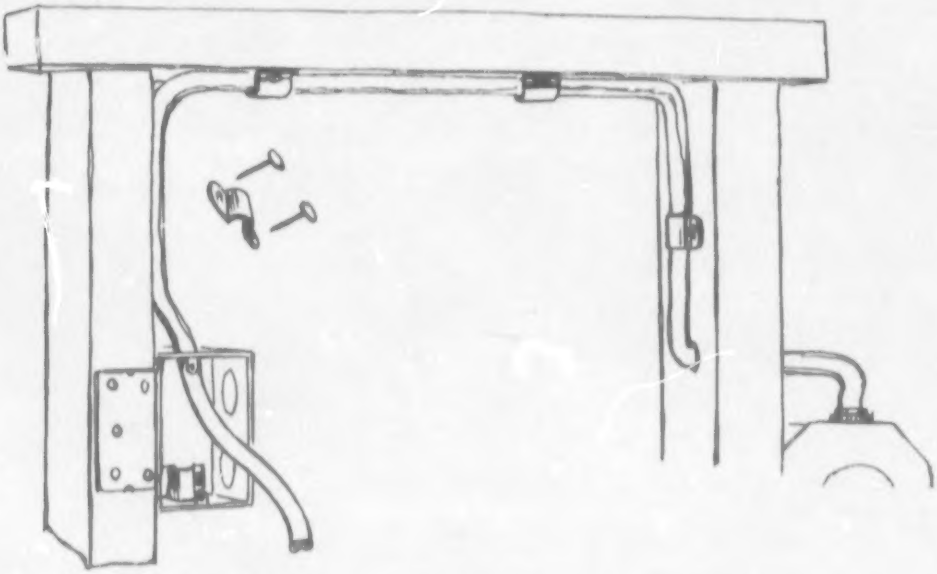
NOTE!

Switch boxes are mounted about 48 inches from the floor in actual house wire.

4. Mount the switchbox on the stud.

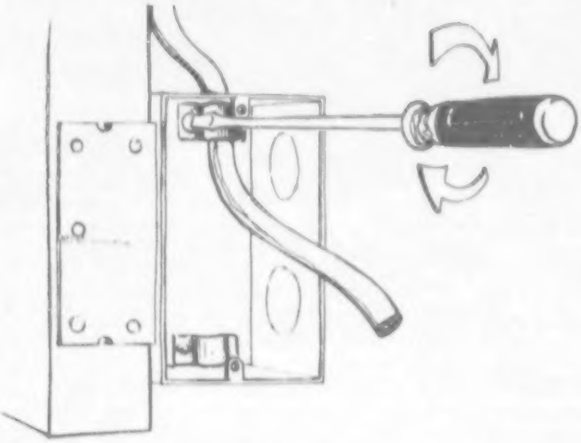


5. Run the cable from the lamp to the switchbox.

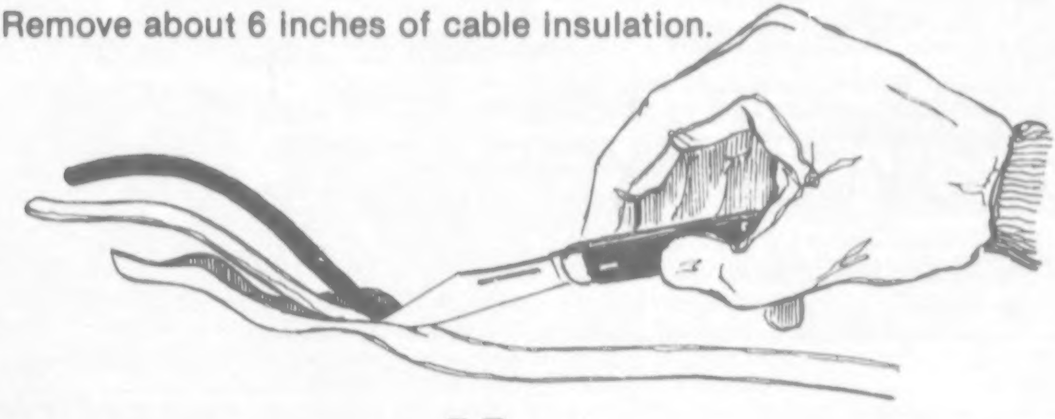


Secure the cable to the studs using cable straps.

6. Connect the cable to the switchbox.

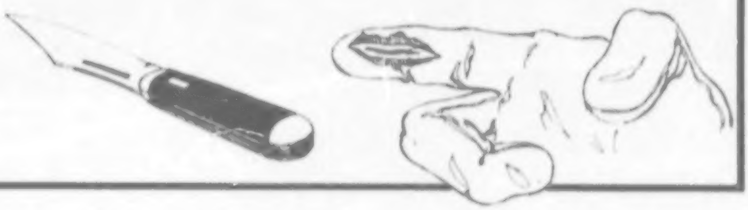


7. Remove about 6 inches of cable insulation.

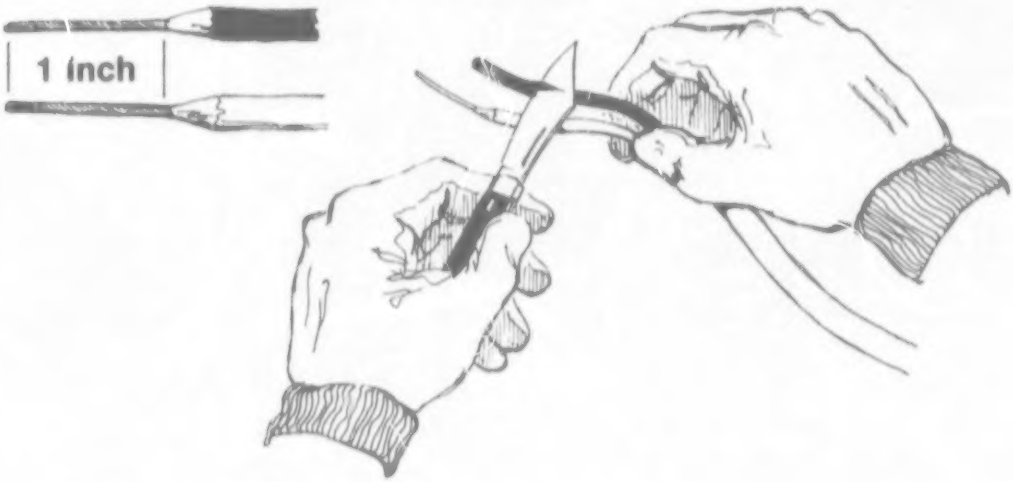


CAUTION!

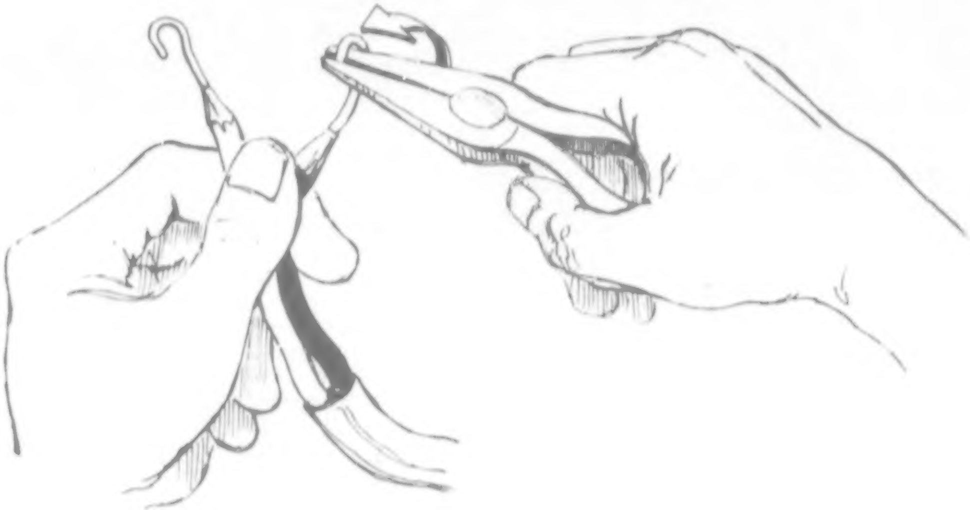
Handle the cutting knife carefully to avoid injury.



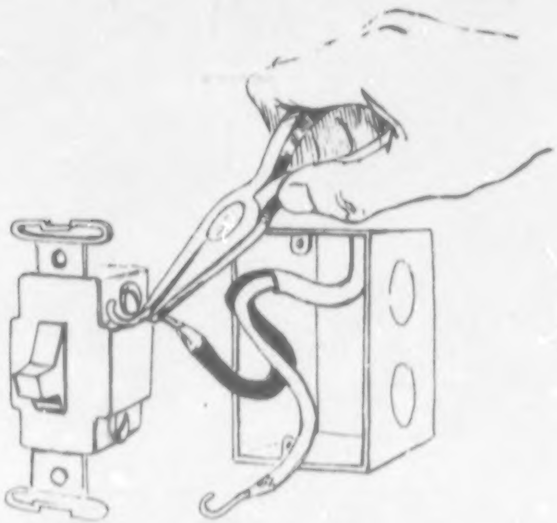
8. Remove insulation from the wires.



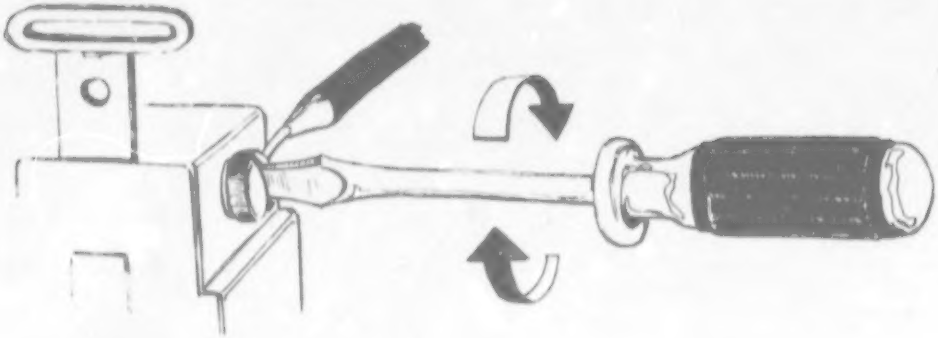
9. Bend the wires into loops.



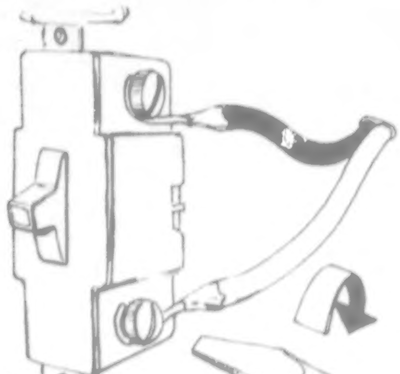
10. Place the black wire loop under one terminal screw on the switch.



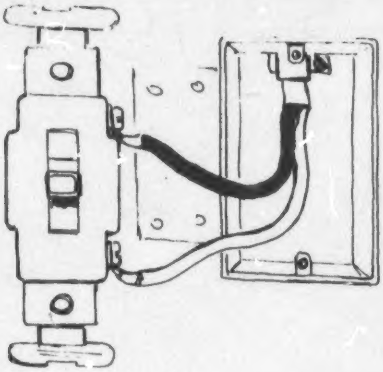
11. Tighten the screw.



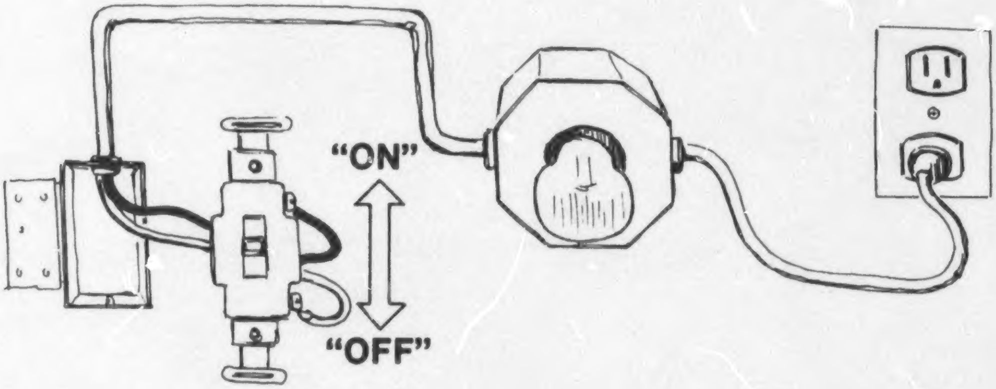
12. Connect the white wire loop to the other screw.



13. Have your instructor inspect your work.



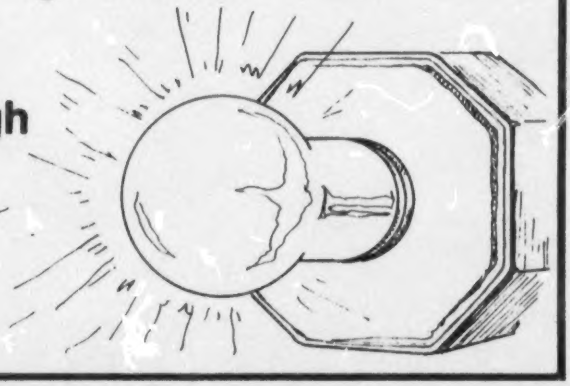
14. Connect your work on the power source. Turn the switch on.



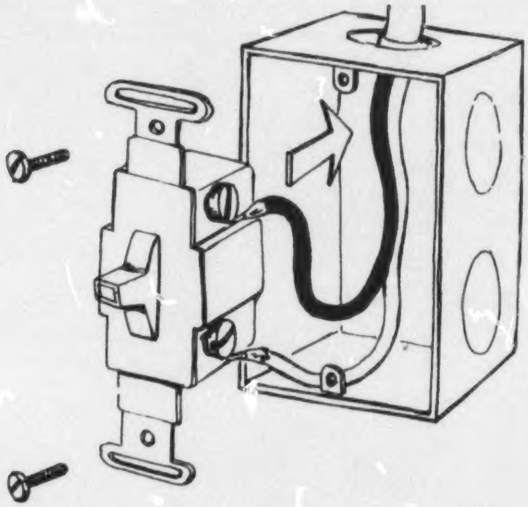
NOTE!

If the wiring is correct the light will come on.
If the wiring is faulty the light will not come on.

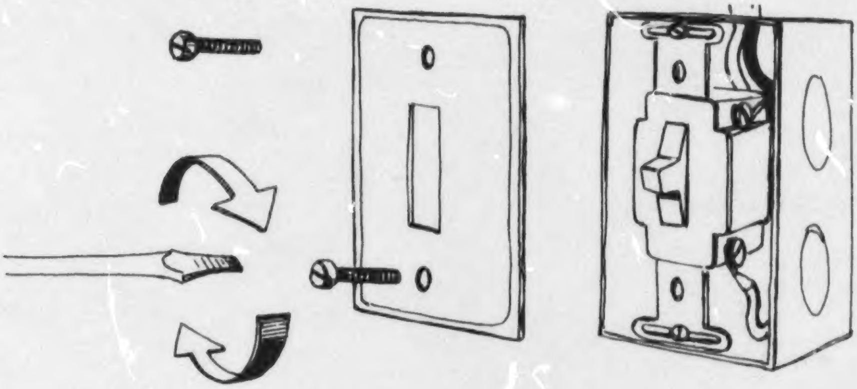
If wiring is faulty have your instructor go through the steps with you.



15. Fold the wires into the box. Install the switch in the box.



16. Install the cover plate.



Have your instructor inspect your work.

17. Clean up your work area and return all tools to their proper places.

SEE YOUR INSTRUCTOR

Unit 7
Installing a Single-Pole Switch

Practical Exercise Performance Checklist

The student ______________________ successfully performed the following tasks:

Tasks	No	Yes	Comments
1. Identified:			
a. Screwdriver			
b. Long-nose pliers			
c. Switch box and cover plate			
d. Cable strap			
e. Single-pole switch			
2. Wore proper safety equipment.			
3. Correctly mounted switch box on the stud.			
4. Ran the cable from the lamp to the switch box and attached cable to the studs.			
5. Connected cable to the switch box allowing sufficient wire length for switch connections.			
6. Removed correct length of outer insulation from the cable.			
7. Correctly stripped the wires.			
8. Bent the wires into loops.			
9. Correctly attached and tightened the black and white wires to the terminal screws.			
10. Checked completed wiring with instructor.			
11. Connected work to power source and turned on the switch.			
12. Properly tucked the wires into switch box and installed the switch.			

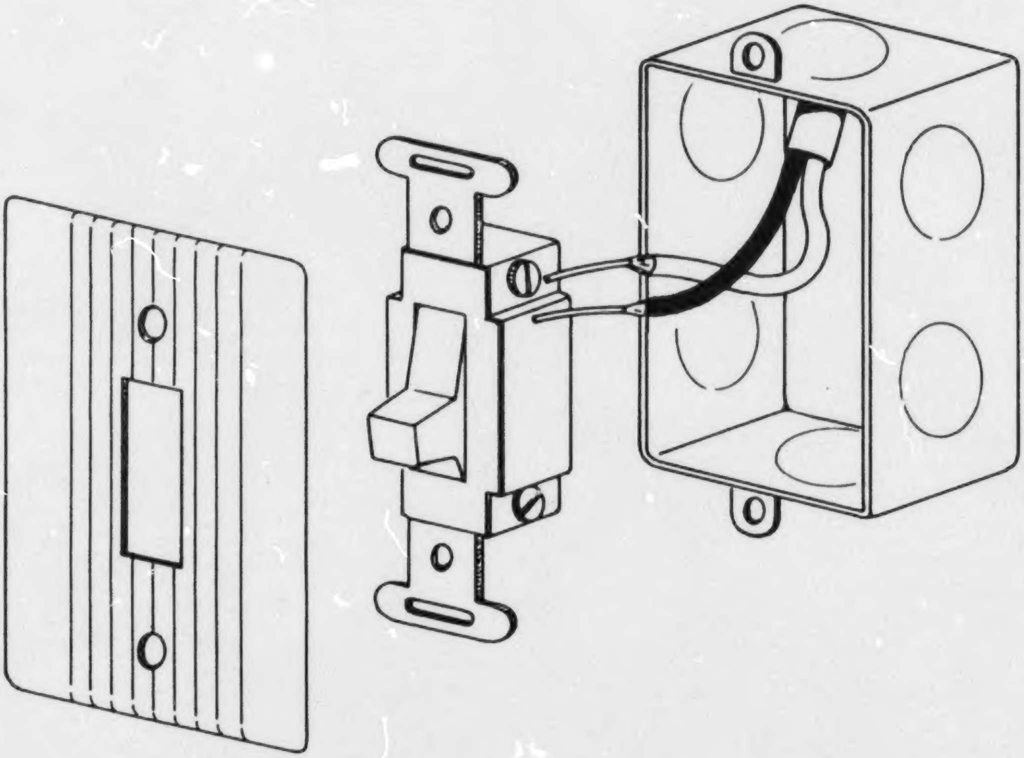
Tasks	No	Yes	Comments
13. Attached the cover plate to the switch box.			
14. Cleaned up work area and returned tools to their proper places.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

Instructor's Signature

Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 8

Installing Series Wiring

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION

iml

INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 8
Installing Series Wiring

Installing Series Wiring.

After you study this lesson, you should be able to:

1. Identify tools and materials used in series wiring.
2. Install lamp bases.
3. Wire lamps in series.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

SEE YOUR INSTRUCTOR

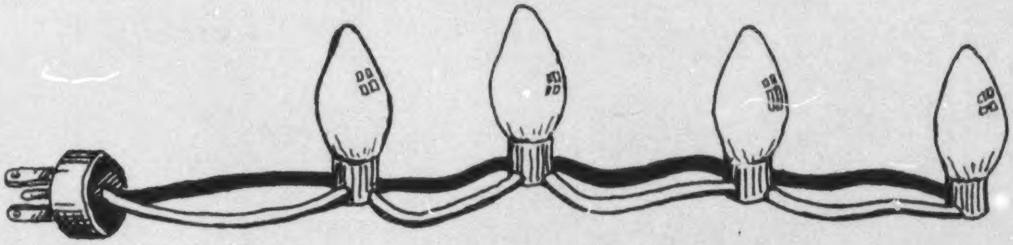
2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

TURN THE PAGE AND BEGIN

Unit 8
Installing Series Wiring

Introduction

Series wiring provides only one path for an electrical current to travel. A break of flow at any point stops the electrical flow. Christmas tree lights are an example of series wiring.



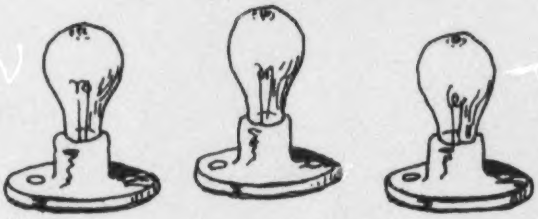
In this lesson you will learn how to wire lamps in series.

TURN TO NEXT PAGE

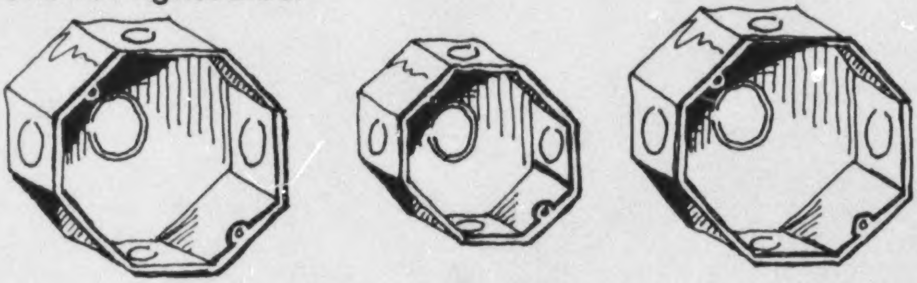
Unit 8
Installing Series Wiring

A. Tools, Materials and Equipment for Wiring in Series.

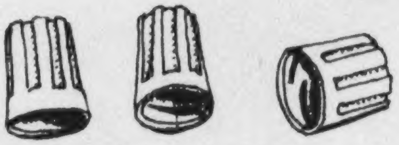
1. **THREE LIGHTBULB ASSEMBLIES:** Material to be wired in series.



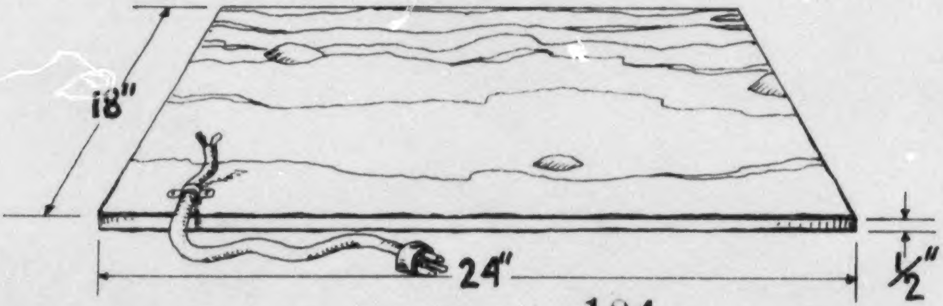
2. **THREE OCTAGONAL BOXES:** Used to contain wiring connections for lightbulbs.



3. **WIRE NUTS:** Used to hold solderless connections or pigtail splice.



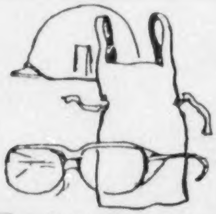
4. **PLYWOOD BASE:** Surface for mounting switch box and outlet boxes.



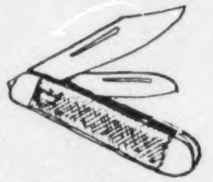
Unit 8
Installing Series Wiring

A. Steps for Installing Series Wiring.

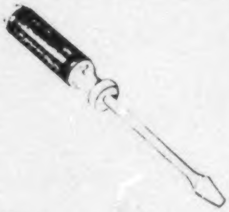
1. Find and Check Off the following.



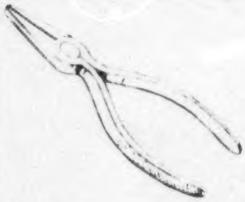
☐ Safety Equipment



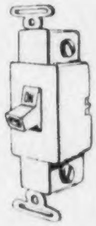
☐ Pocket Knife



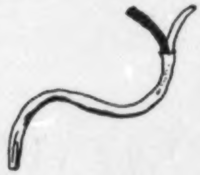
☐ Screwdriver



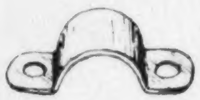
☐ Long-nose Pliers



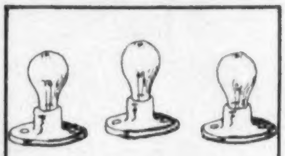
☐ Switch



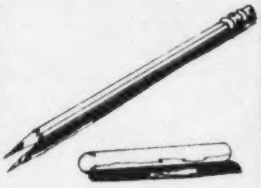
☐ NM 12/2 Cable



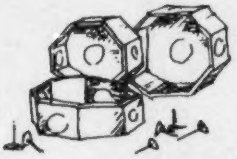
☐ Cable Strap



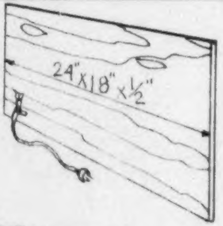
☐ Lightbulbs & Bases



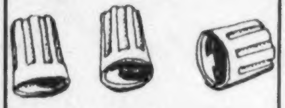
☐ Pencil or Chalk



☐ Outlet Boxes

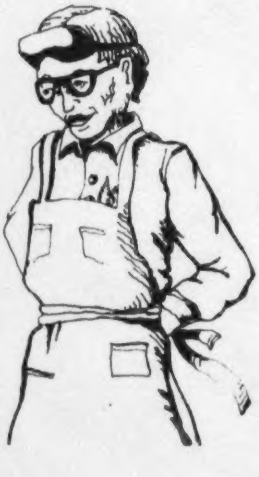


☐ Plywood

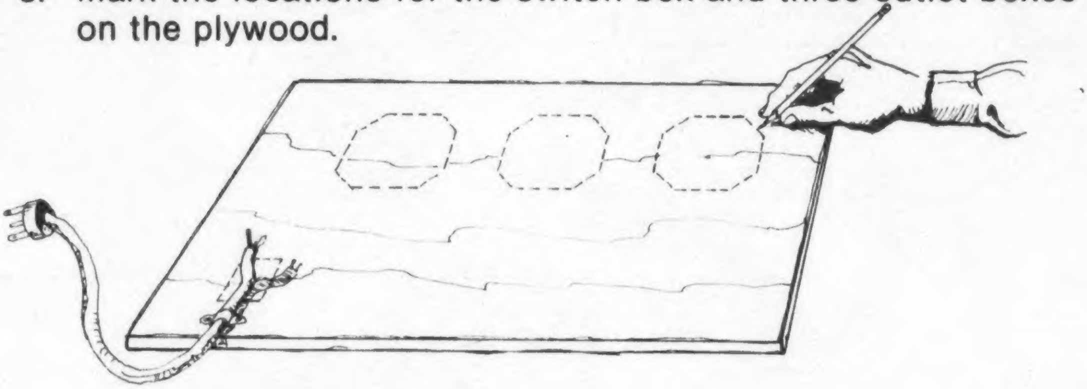


☐ Wire Nuts

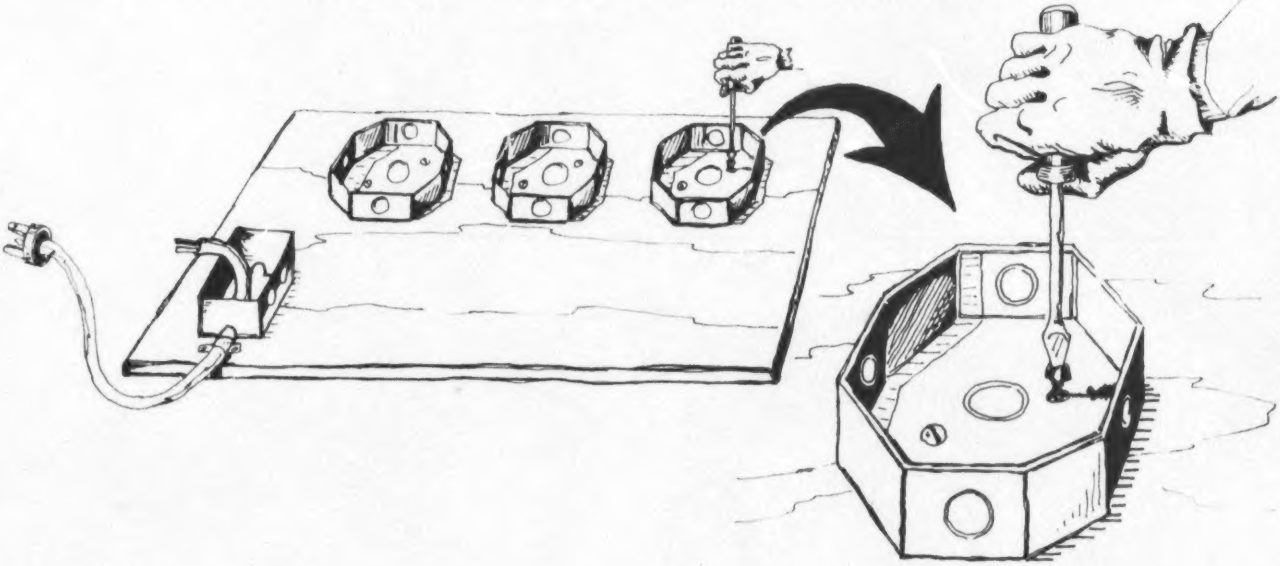
2. Put on proper safety equipment.



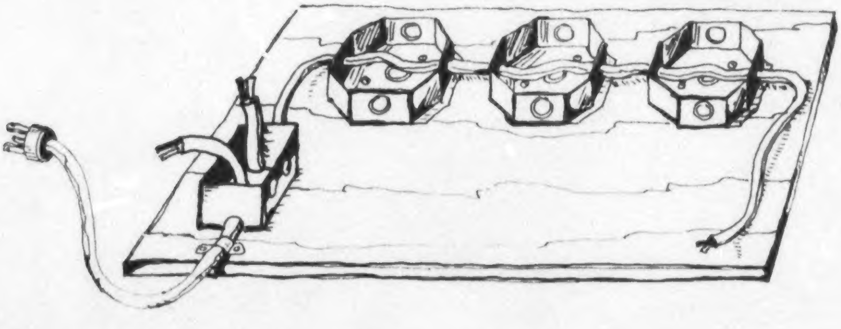
3. Mark the locations for the switch box and three outlet boxes on the plywood.



4. Secure the switch box and outlet boxes to the plywood.

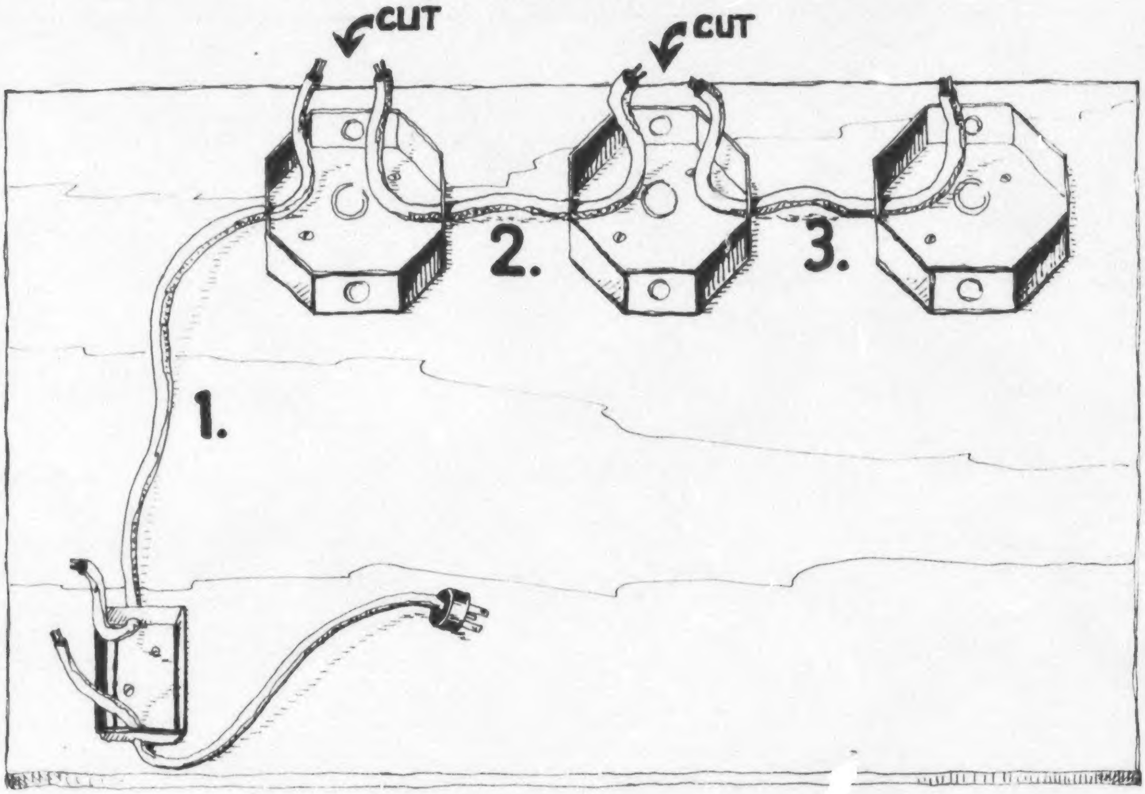


5. Run the cable from the switch box through the three outlet boxes.

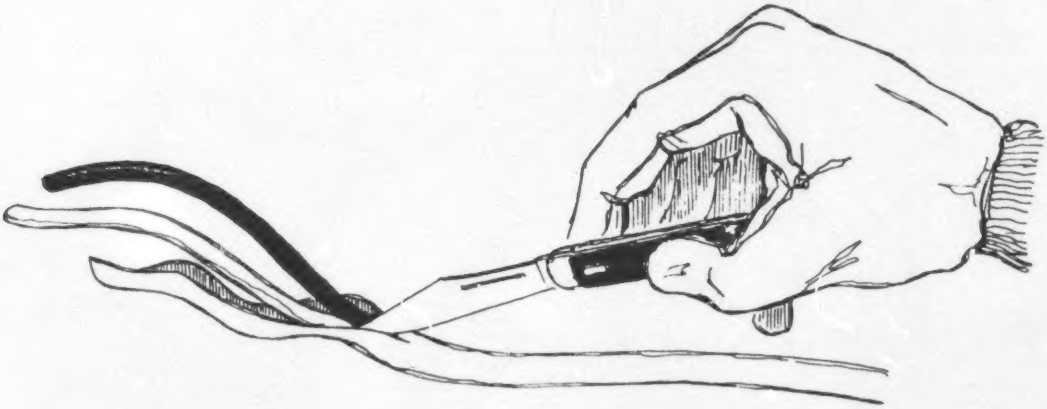


Allow extra length for connections.

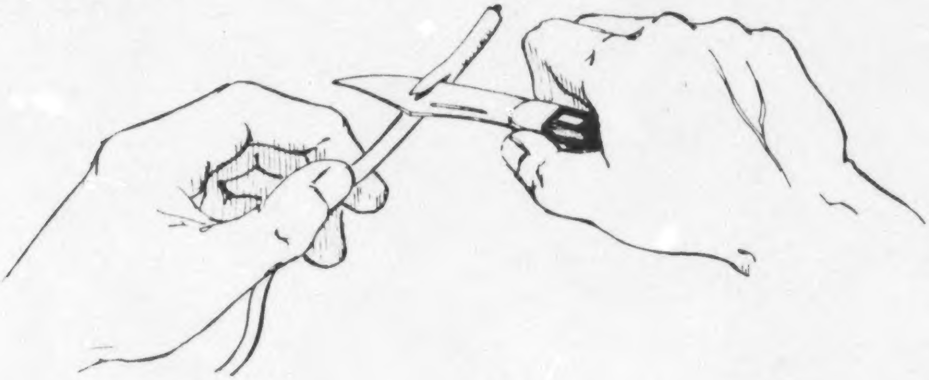
6. Cut the cable into three pieces. Cut at each box location.



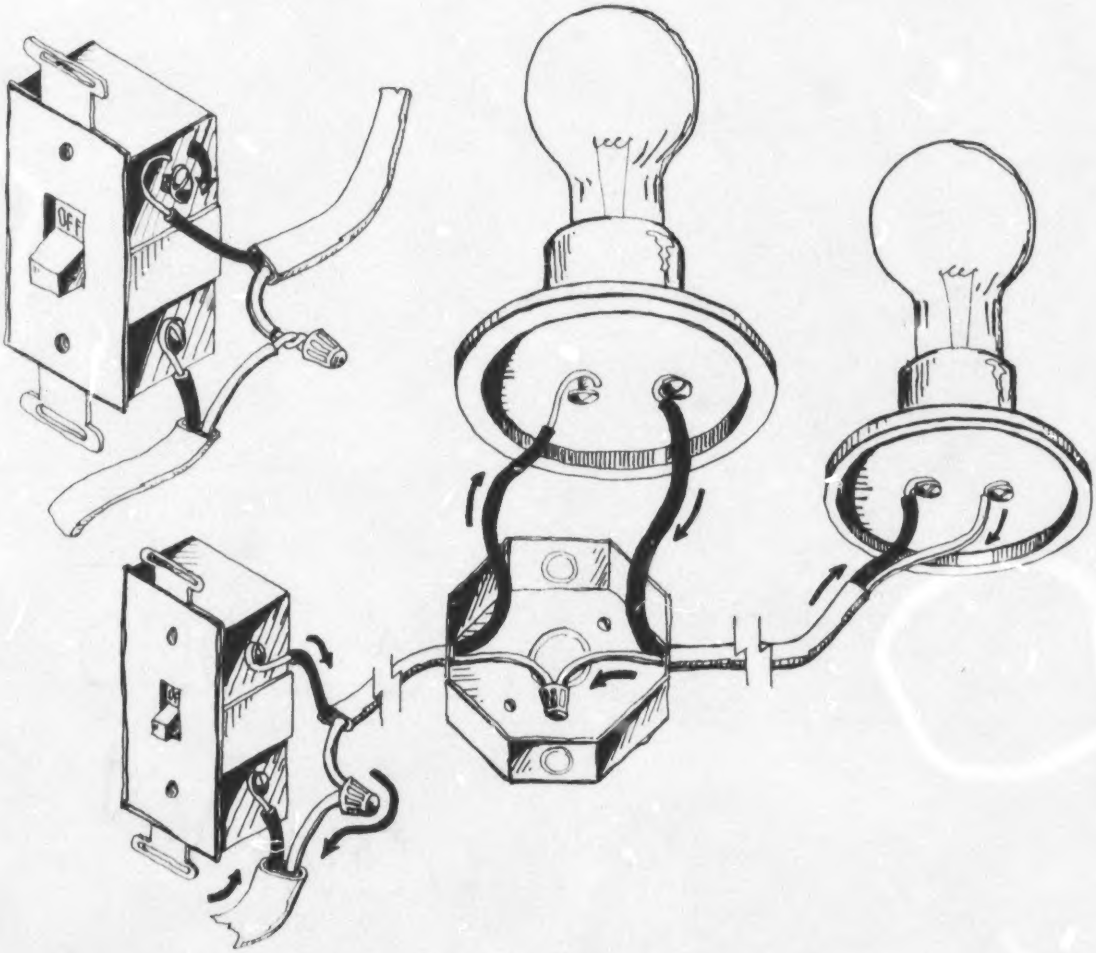
7. Remove about 6 inches of outer insulation from the ends of each cable piece.



8. Remove about 3/4" of insulation from the ends of the black and white wires you have exposed.



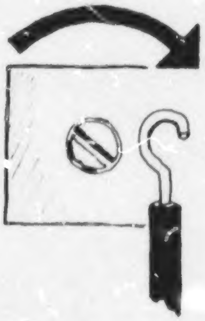
9. Loop the bare ends of the black wire pieces. Connect the black wire to the lamp bases; then to the switch.



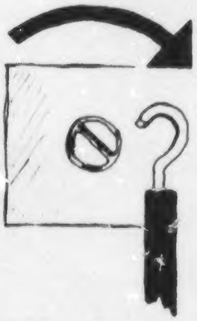
Connect the white wire ends with wire nuts.

NOTE!

Always attach the wire loops in the direction the screw turns.

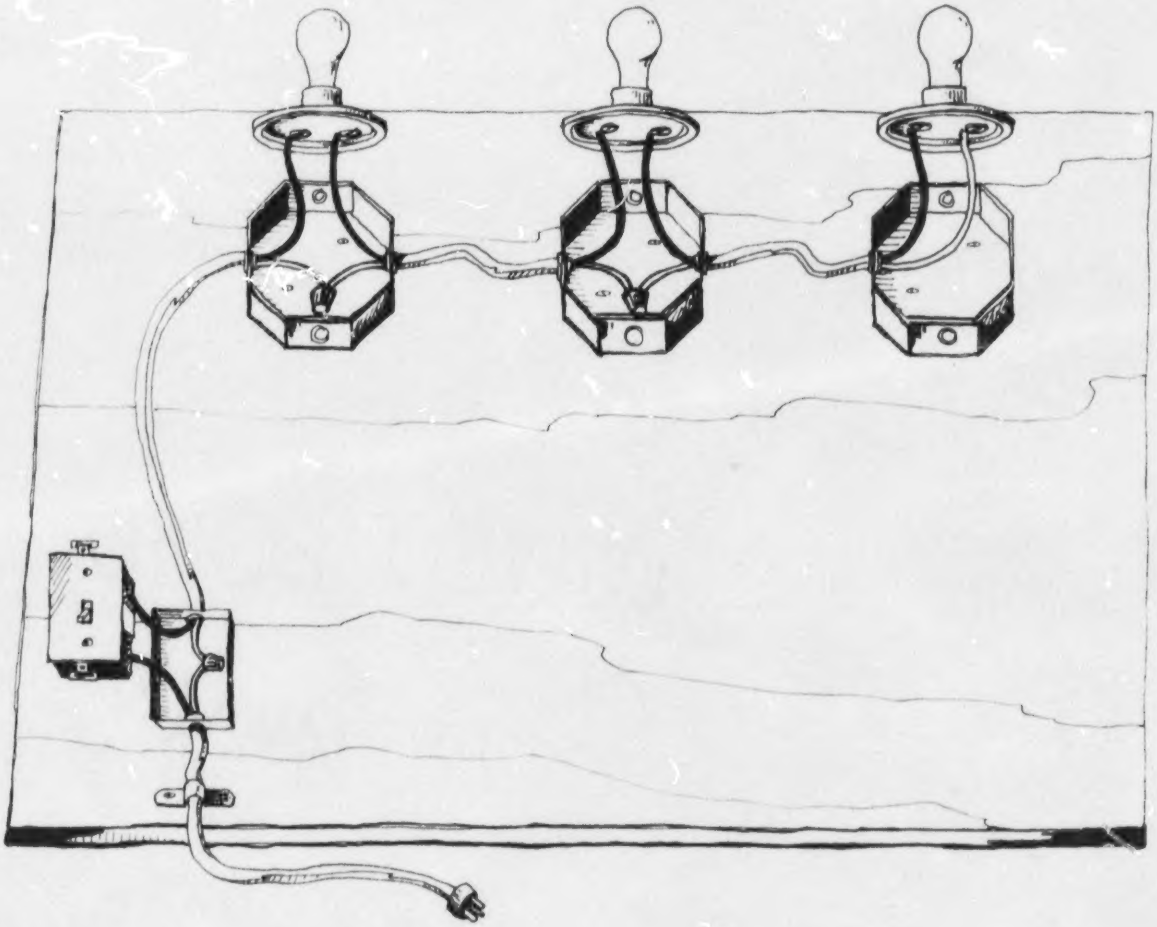


Correct

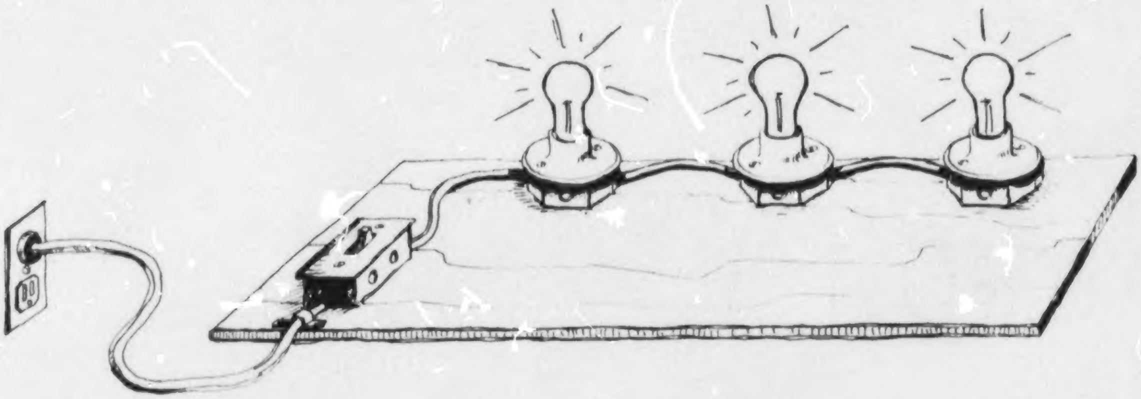


Incorrect

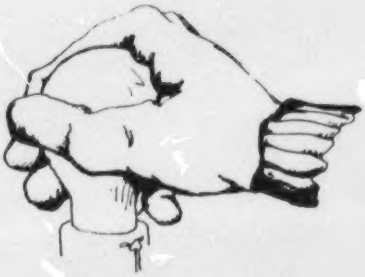
10. When all the wires are connected, have your instructor check your work.



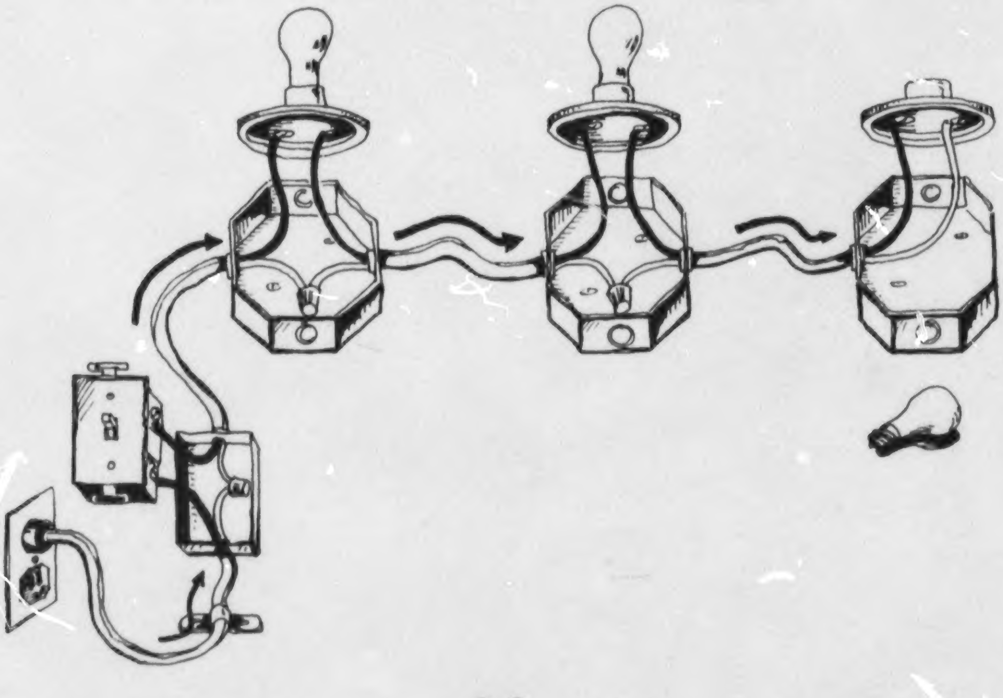
11. Connect the plug to a power source. Turn the light switch on and observe whether all the lamps will glow.



12. Turn the switch off. Remove one light bulb.



13. Now, switch the light back on. What do you observe?



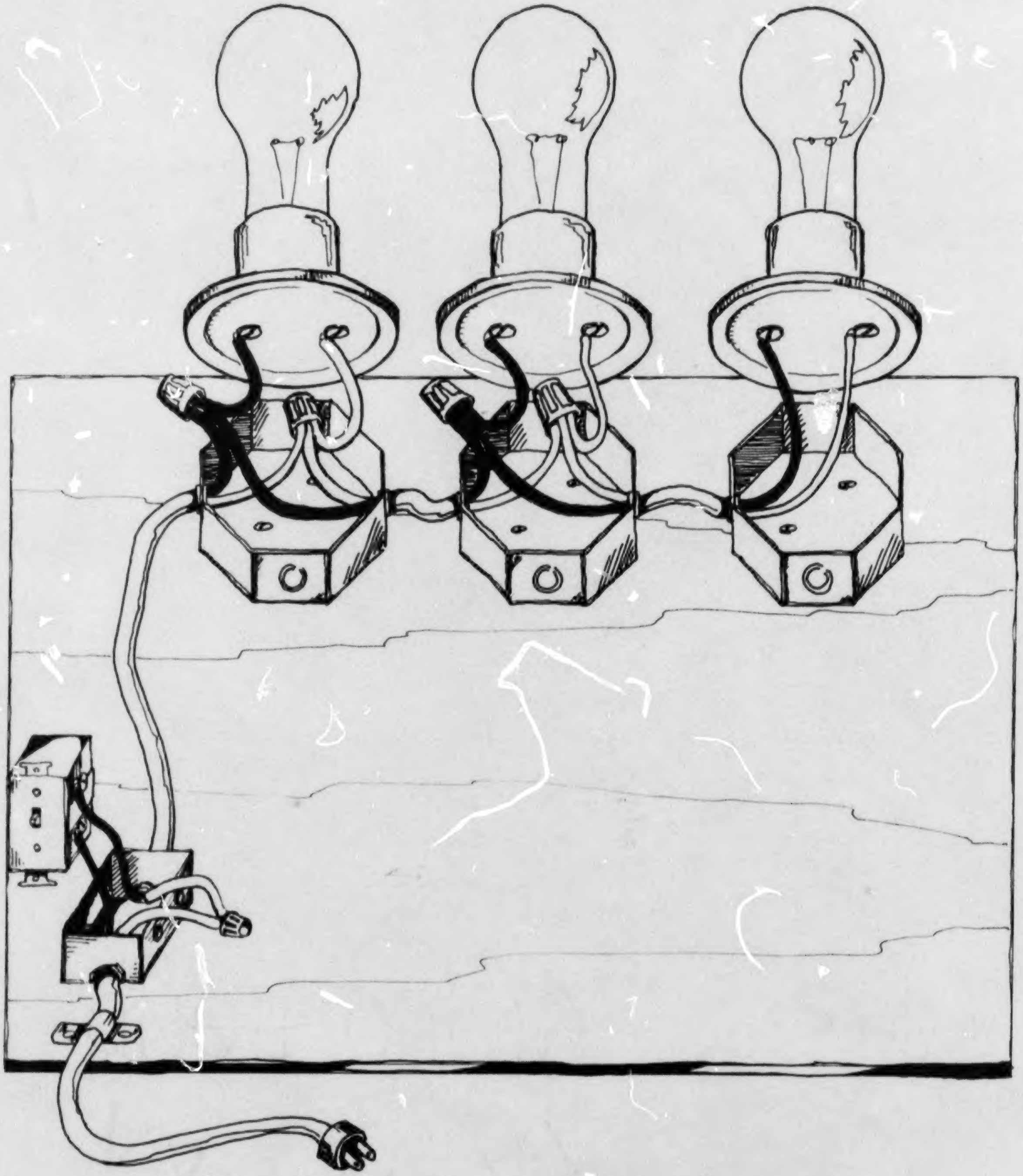
NOTE!

The two bulbs will not light because you have stopped the flow of electricity. This is one important behavior of series wiring.

14. Clean up your work area. Return tools and materials to their proper places.

Series wiring is not used in house wiring. Parallel wiring is used in houses because it provides more than one path for current flow. If one lamp is removed from the parallel path, the current will flow through other paths.
Parallel wiring is shown on the next page.

SEE YOUR INSTRUCTOR



PARALLEL WIRING

Unit 8
Installing Series Wiring

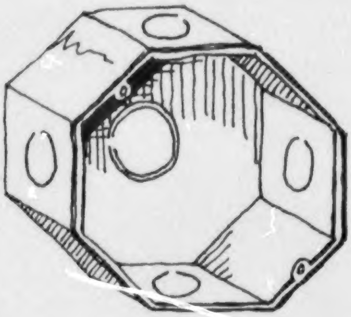
Tools and Materials Identification Exercise

Match each object with its correct name.

_____ A. Light Bulb Assembly

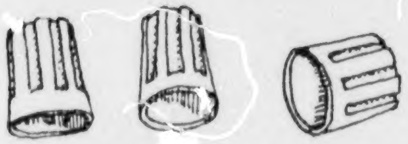
_____ B. Octagonal Box

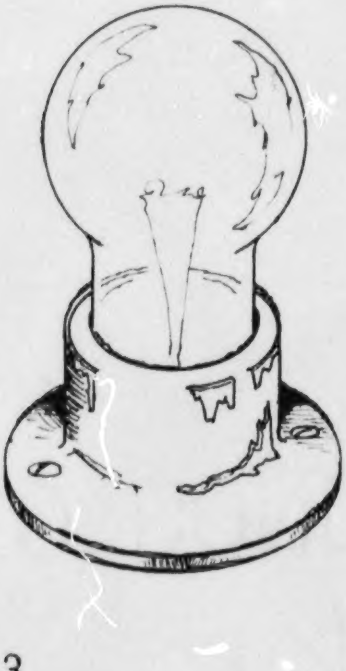
_____ C. Wire Nut



1.

2.





3.

Unit 8
Installing Series Wiring

Practical Exercise Performance Checklist

The student ______________________ successfully performed the following tasks:

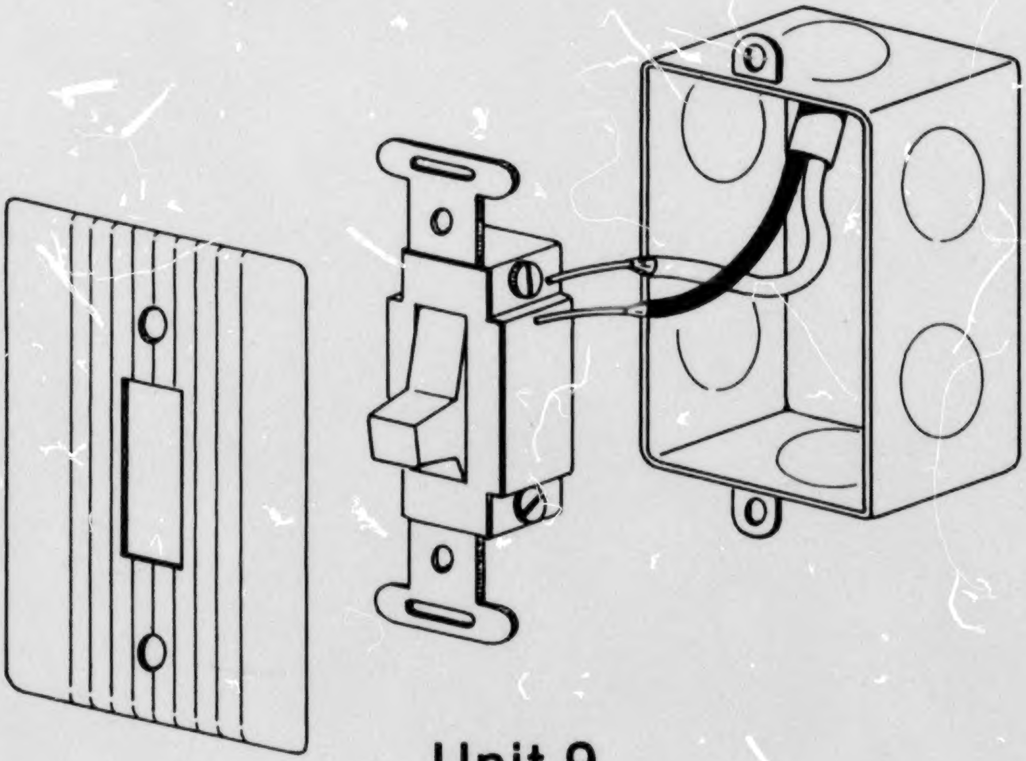
Tasks	Yes	No	Comments
1. Identified:			
a. Light bulb assembly			
b. Octagonal box			
c. Wire nut			
2. Wore proper safety equipment.			
3. Located and marked positions for the switch and outlet boxes.			
4. Secured switch and outlet boxes.			
5. Properly ran the cable from the switch box through the three outlet boxes.			
6. Cut cable at each box location for connections.			
7. Removed about 6 inches of outer insulation from the ends of cablepieces.			
8. Removed about 3/4" of insulation from the ends of the black and white wires.			
9. Correctly connected the black wire pieces to lamp bases and switch box.			
10. Correctly connected ends of the white wire pieces with wire nuts.			
11. Checked connections for correctness.			
12. Connected work to power source to see if it would work.			
13. Removed one lamp to observe one feature of series wiring.			
14. Cleaned up work area and returned tools to their proper places.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ Instructor's Signature

__________ Date

Vocational Preparation Curriculum
ELECTRICAL WIRING



Unit 9

Installing and Wiring Outlets in Parallel

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION
iml
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 9
Installing and Wiring Outlets in Parallel

Installing and Wiring Outlets In Parallel

After you study this lesson, you should be able to:

1. Identify tools and materials used to install and wire outlets in parallel.
2. Install and wire outlets in parallel.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

   SEE YOUR INSTRUCTOR

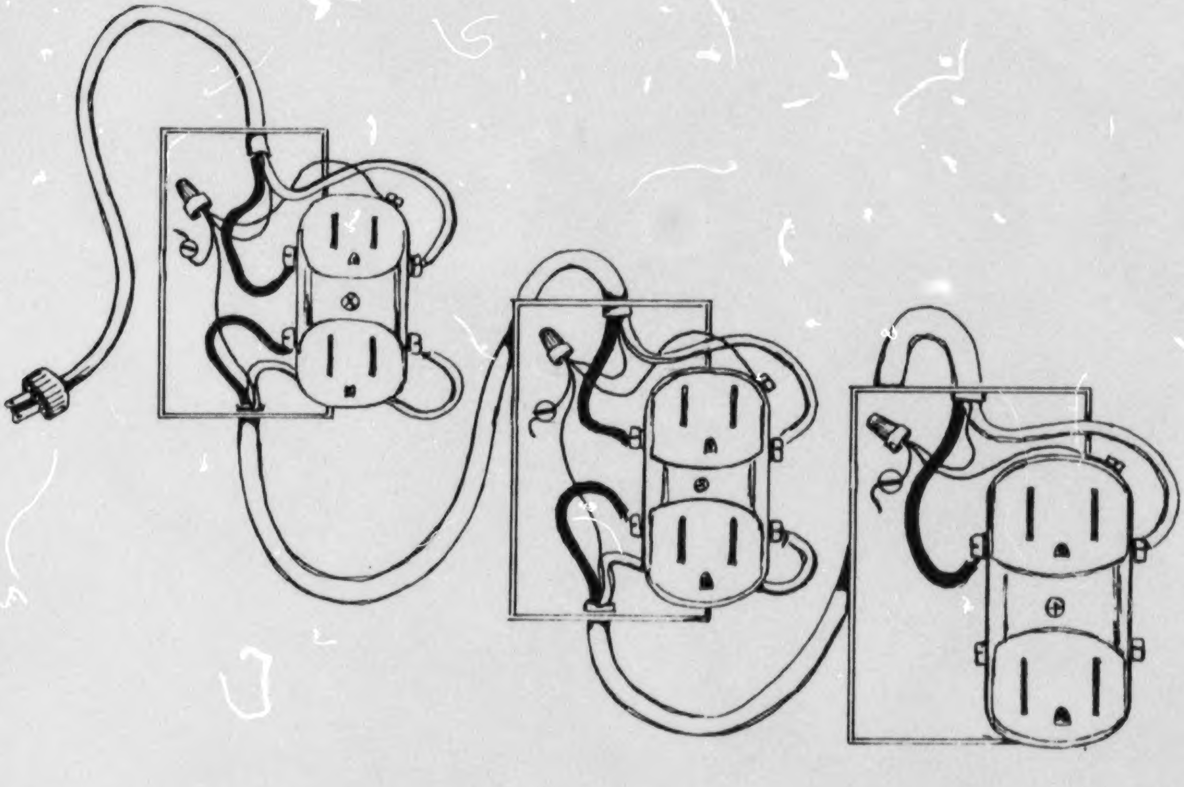
2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

   TURN THE PAGE AND BEGIN

Unit 9
Installing and Wiring Outlets in Parallel

Introduction

You have learned how to do wiring using the series method. This lesson will show you the parallel method of wiring. Parallel wiring is the preferred method because it provides more than one path for the flow of electrical current.



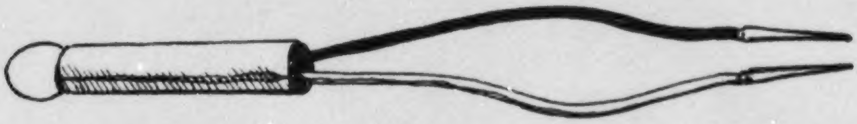
TYPICAL PARALLEL OUTLETS

TURN TO NEXT PAGE

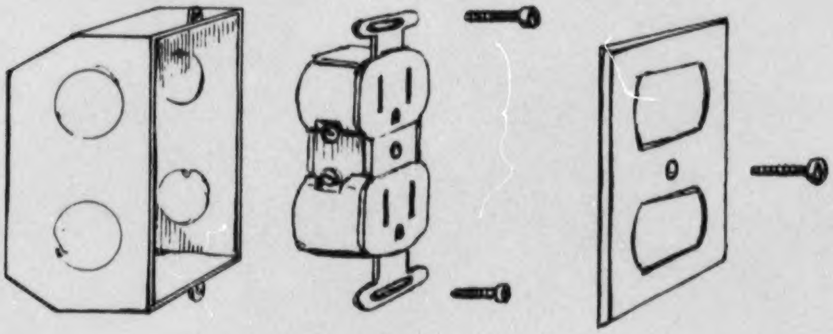
Unit 9
Installing and Wiring Outlets in Parallel

A. Tools, Materials and Equipment for Installing and Wiring Outlets in Parallel.

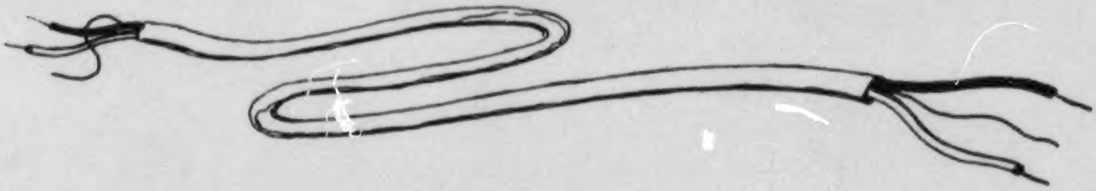
1. **TEST LIGHT:** Used to test the presence of electrical current in an outlet.



2. **THREE DUPLEX OUTLET ASSEMBLIES:** Provides means from which electricity can be tapped from electrical current.



3. **GROUNDED CABLE:** Electrical conductor with two conducting wires and one ground wire.



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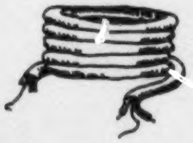
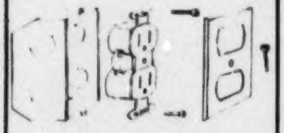
Unit 9
Installing and Wiring Outlets in Parallel

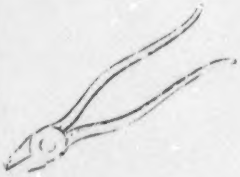
B. Steps for Installing and Wiring Outlets in Parallel.

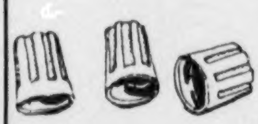
1. Find and Check Off the following.

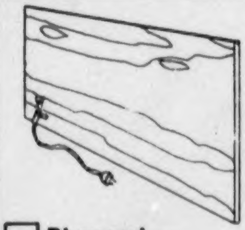

☐ **Grounded Cable**

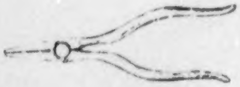

☐ **Outlet Assemblies**

☐ **Test Light**


☐ **Side Cutting Pliers**

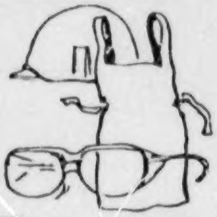

☐ **Wire Nuts**


☐ **Plywood**

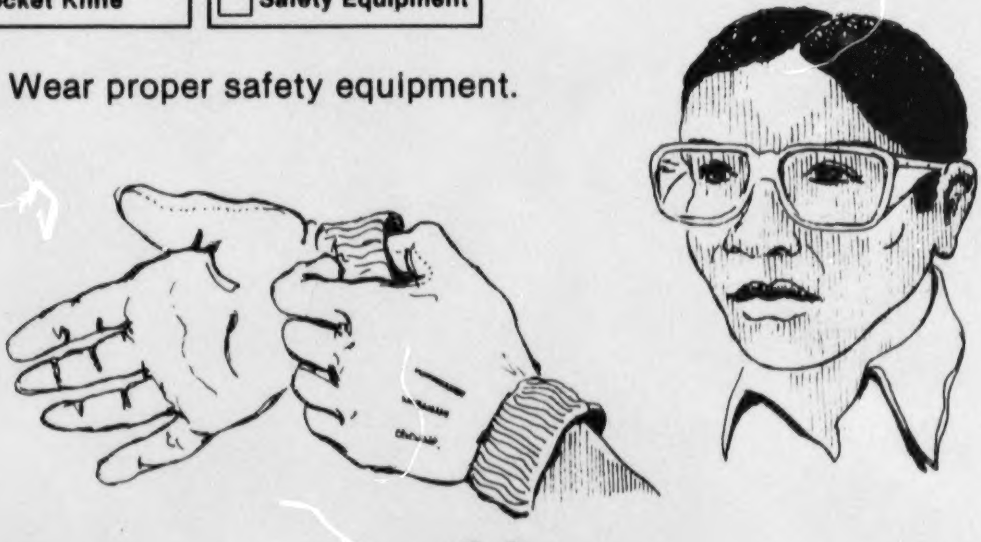

☐ **Long-nose Pliers**

☐ **Flathead Screwdriver**

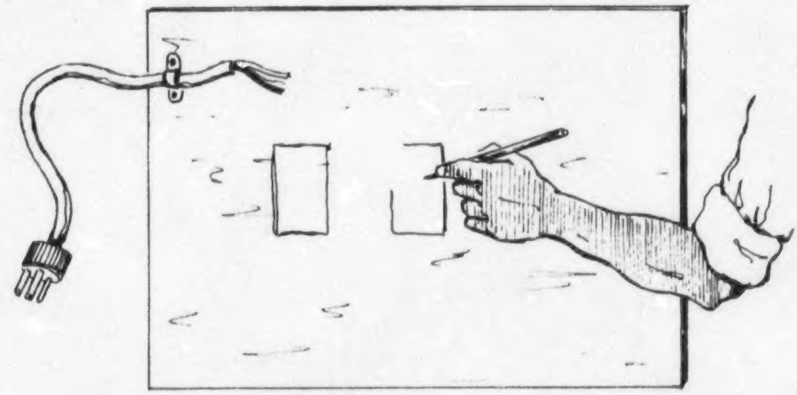
☐ **Pocket Knife**


☐ **Safety Equipment**

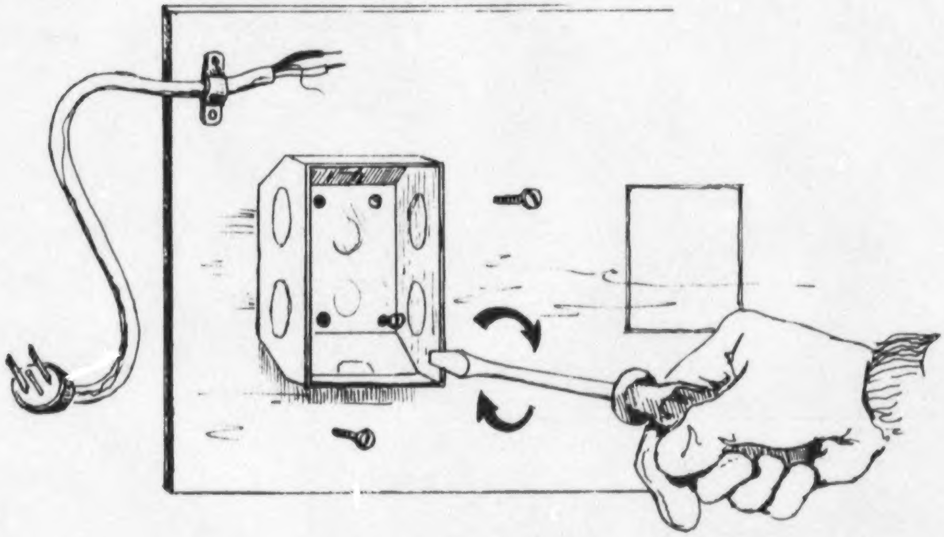
2. Wear proper safety equipment.



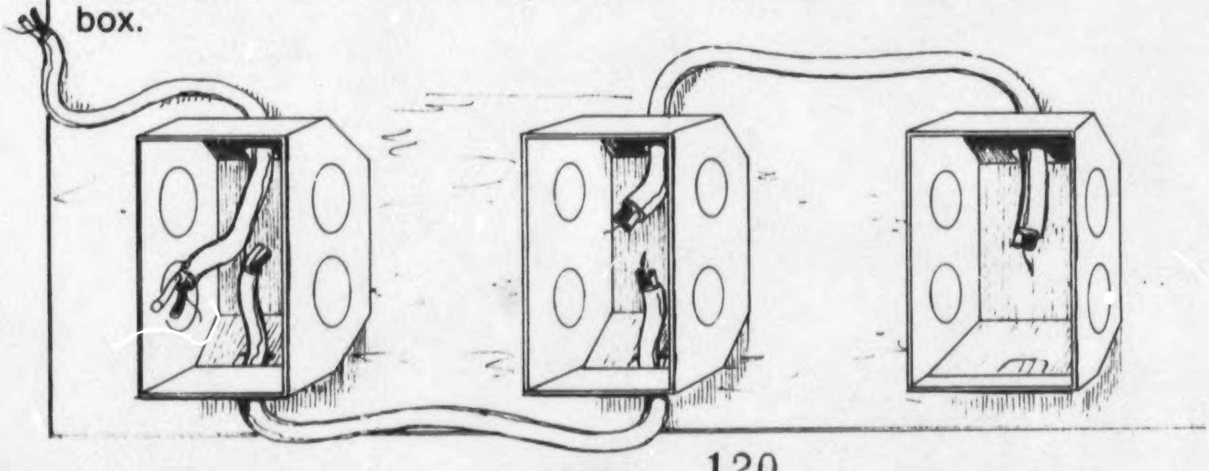
3. Locate and mark positions for the boxes on the plywood sheet.



4. Attach the three outlet boxes to the plywood surface.

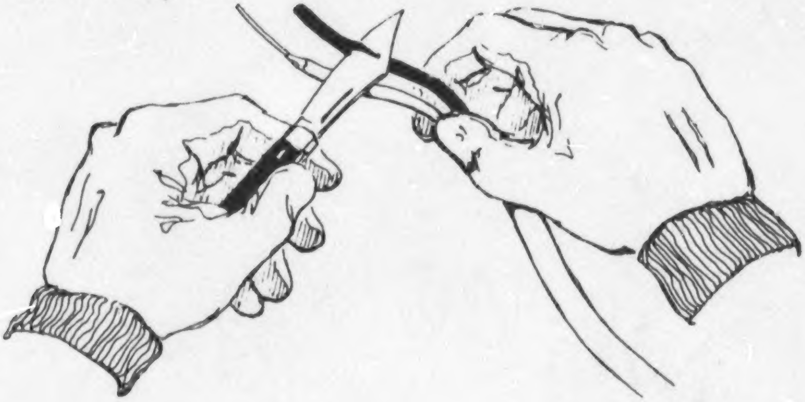


5. Cut the NM 12/2 cable and position the pieces in each outlet box.

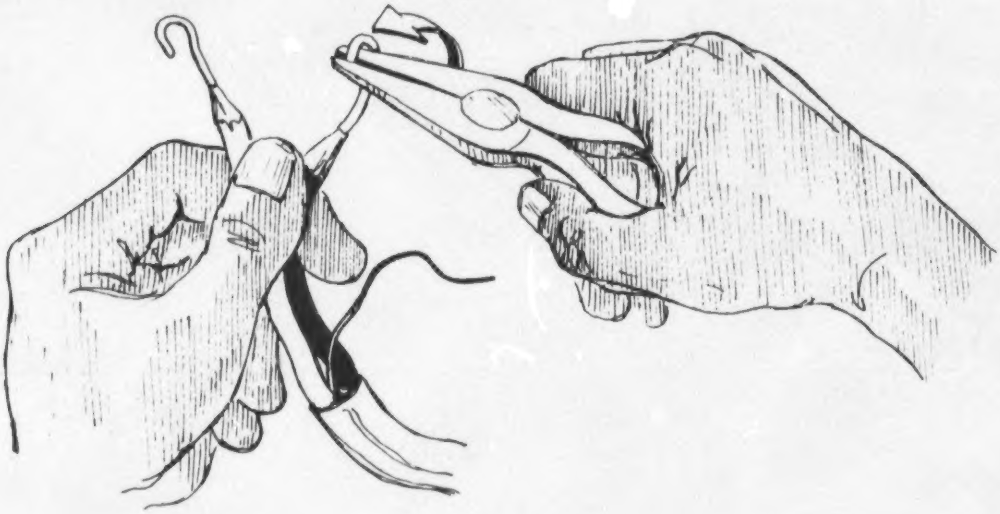


6. Remove about 6" of outer covering from the cable.

   Strip 3/4" of insulation from each end of the current carrying wires (the black and white).

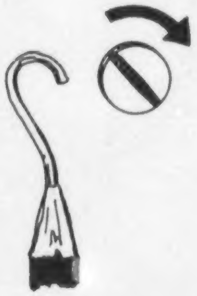


7. Bend the bare wire ends into loops.

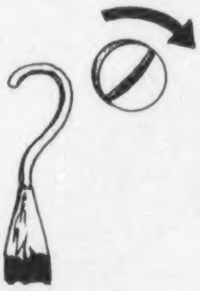


NOTE!

Always point the wire loop in the direction the screw turns.

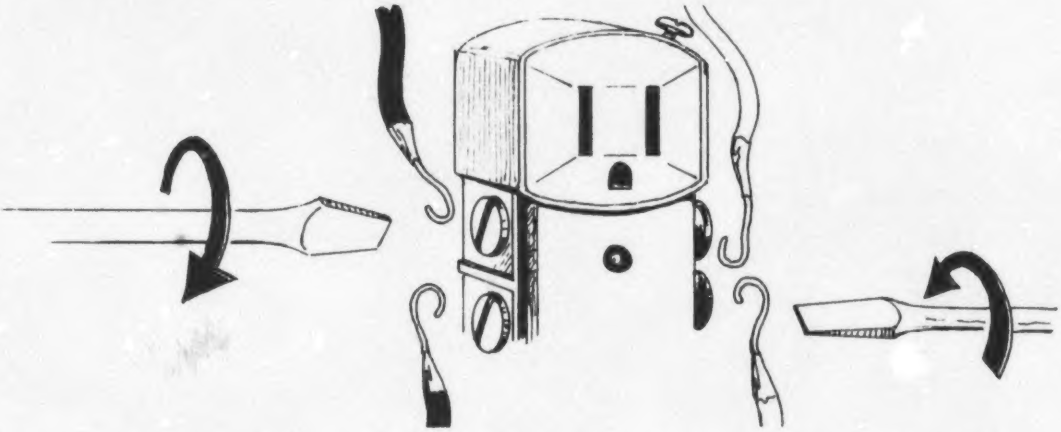


Correct



Incorrect

8. Place the loop of the black wire under the brass screw on the electrical outlet and tighten the screw.

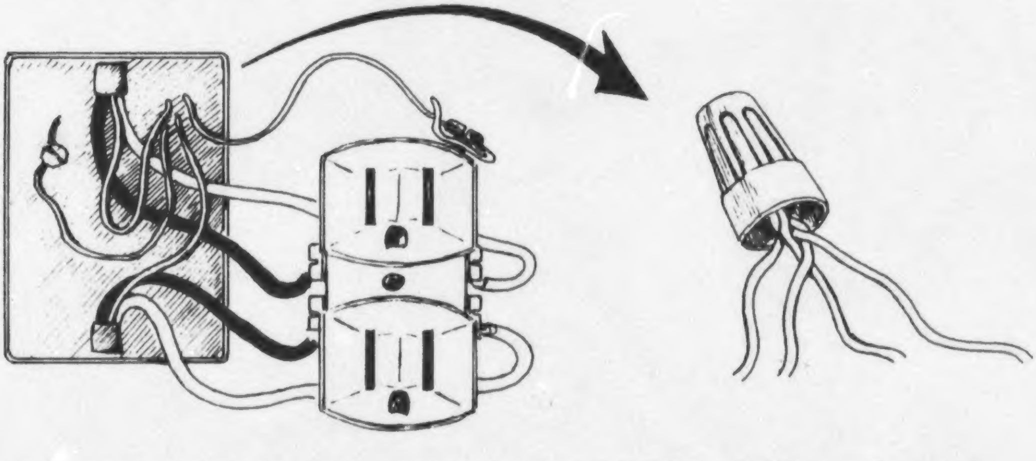


Place the white wire loop under the aluminum screw. Tighten this screw.

NOTE!

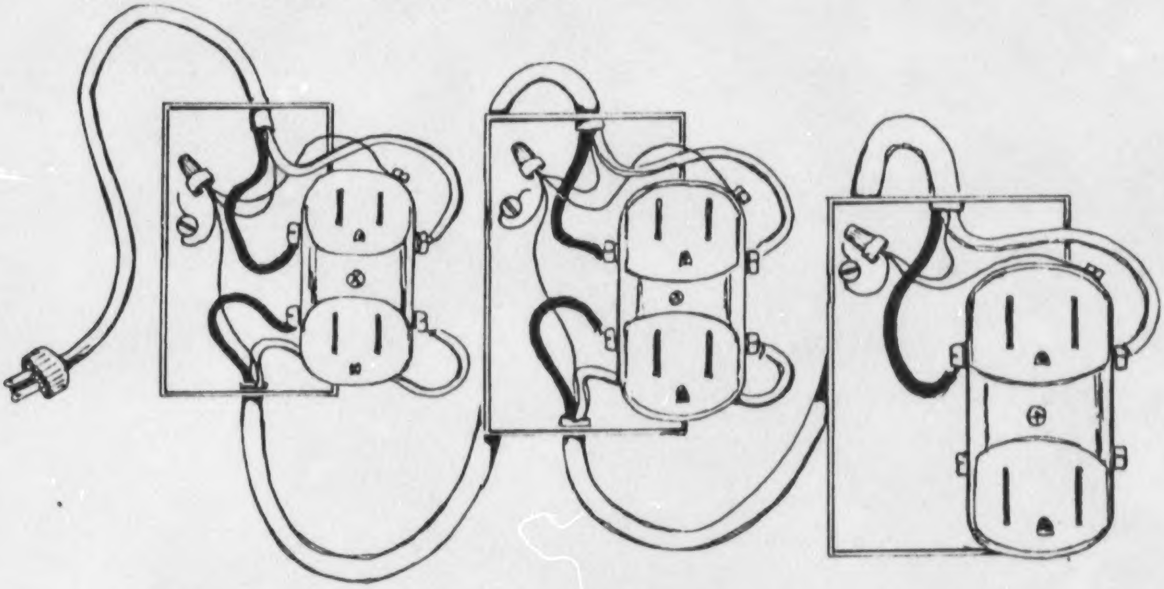
Always attach the black wire to the brass screw and the white wire to the aluminum screw on the receptacle.
The green screw always takes the ground wire.

9. Secure two additional pieces of ground wire.
Loop and connect the end of one piece to the green screw.
Connect the end of the other piece to the receptacle box.

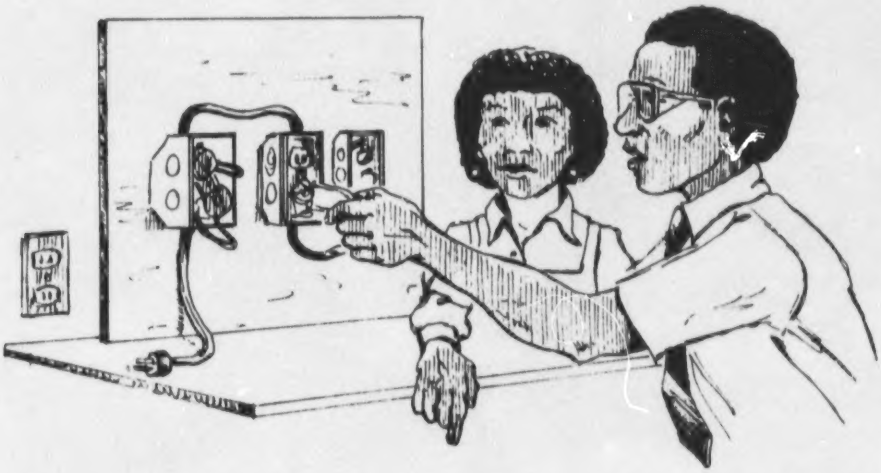


Connect the four free ends of ground wires with a wire nut.

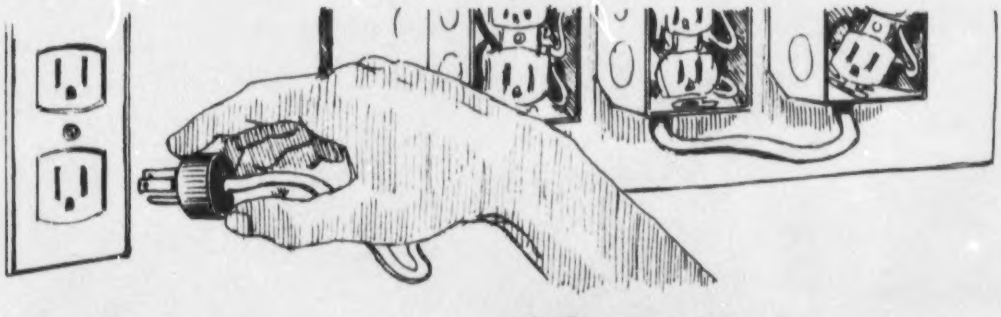
10. Wire the remaining outlets in the same manner.
The last box will have only three ground wire ends to be connected with the wire nut.



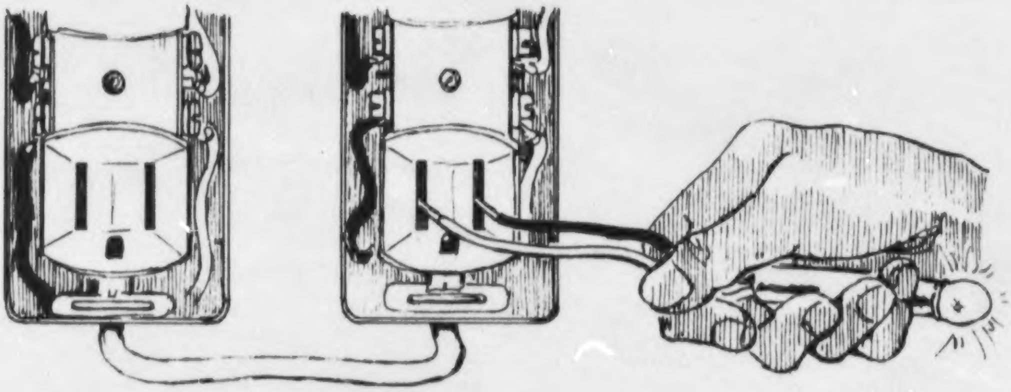
11. Have your instructor check your wiring connections.



12. Connect your work to power source.

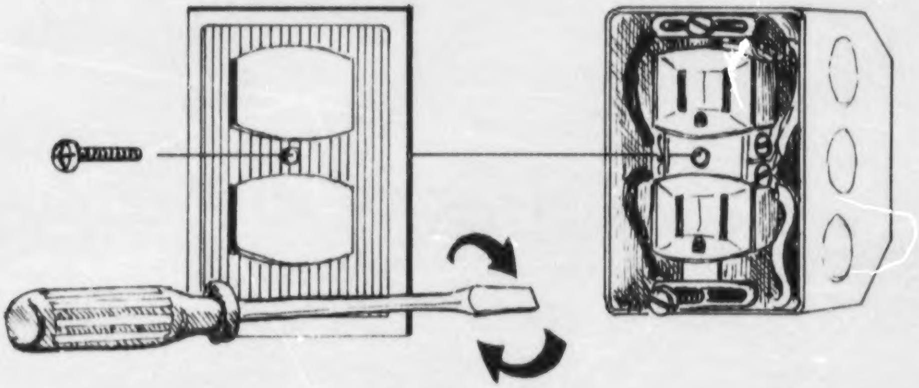


13. Insert the test light leads into each outlet and see if it glows.



If it does not glow, have your instructor check the connections with you.

14. Tuck the wires into the boxes and secure the outlets to the boxes with their screws.



Attach each box cover plate.

15. Have your instructor check the finished work with you.

16. Clean your work area, and return all tools and materials to their proper places.

SEE YOUR INSTRUCTOR

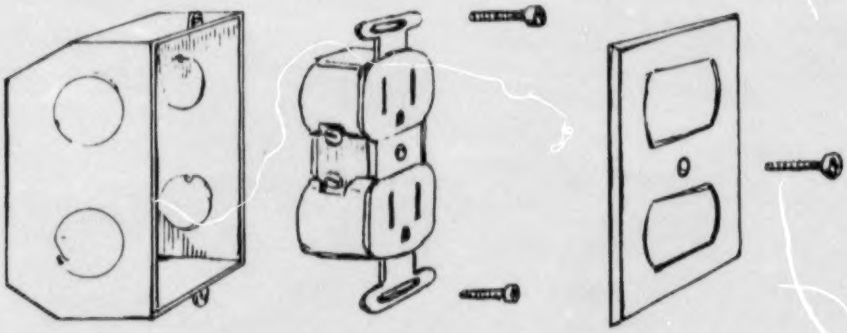
Unit 9
Installing and Wiring Outlets in Parallel

Tools and Materials Identification Exercise

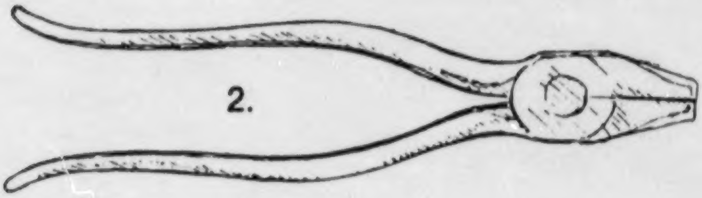
Match each object with its correct name.

______ A. Test Light
______ B. Duplex Outlet
______ C. Grounded Cable
______ D. Long-nose Pliers
______ E. Side Cutting Pliers

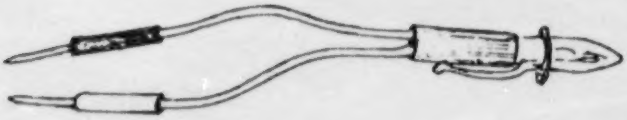
1.



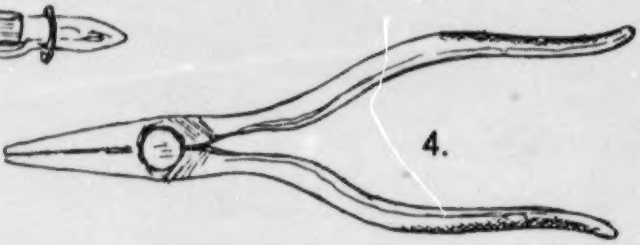
2.



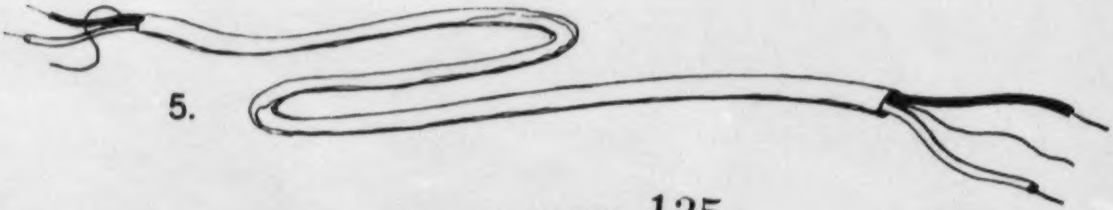
3.



4.



5.



Unit 9
Installing and Wiring Outlets in Parallel

Practical Exercise Performance Checklist

Student ______________________ successfully performed the following tasks:

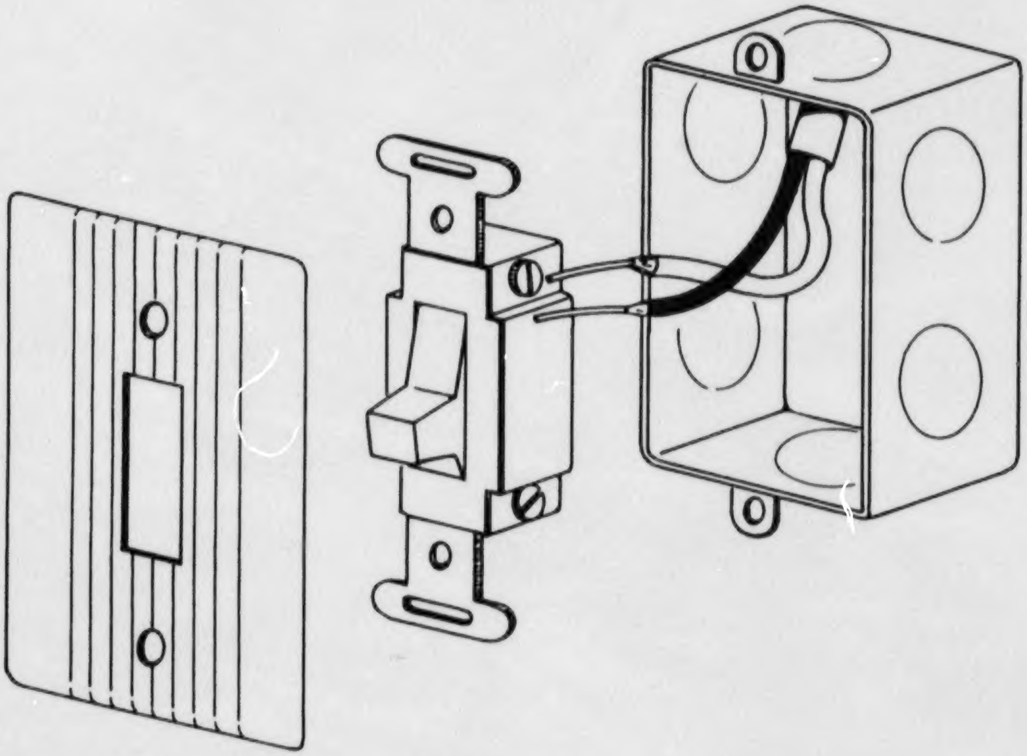
Tasks	Yes	No	Comments
1. Identified:			
a. Test light			
b. Duplex outlet			
c. Ground wire			
d. Long-nose pliers			
e. Side cutting pliers			
2. Wore proper safety equipment.			
3. Located and marked positions for the boxes.			
4. Attached the outlet boxes to the plywood.			
5. Cut cable into pieces and correctly positioned them in the boxes.			
6. Correctly and safely stripped insulation from each cable piece.			
7. Bent the ends of bare wires into loops.			
8. Attached the black wire loops under the brass screws correctly.			
9. Attached the white wire loops under the aluminum screws correctly.			
10. Attached the ground wire to the green screw and grounded it to the receptacle.			
11. Checked with instructor before, then connected work to power source.			
12. Tested receptacles with test light			
13. Tucked wires into outlet box and secured the outlet with screws.			
14. Correctly installed cover plate on each box.			
15. Checked work with instructor.			
16. Cleaned work area and returned tools and materials properly.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ Instructor's Signature

__________ Date

Vocational Preparation Curriculum
ELECTRICAL CONSTRUCTION



Unit 10

Installing Cable in House Framing

Developed by: Hogan Usoro

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION
iml
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 10
Installing Cable in House Framing

Installing Cable in House Framing

After you study this lesson, you should be able to:

1. Identify tools and materials used to install cable in house framing.
2. Install cable in house framing.
3. Connect cable to an outlet box.

Show What You Can Do.

Check the statement that fits you best.

1. ☐ **I can do all the tasks above and want my instructor to give me the Practical Exercise.**

SEE YOUR INSTRUCTOR

2. ☐ **I want to study the information in this unit before I do the Practical Exercise.**

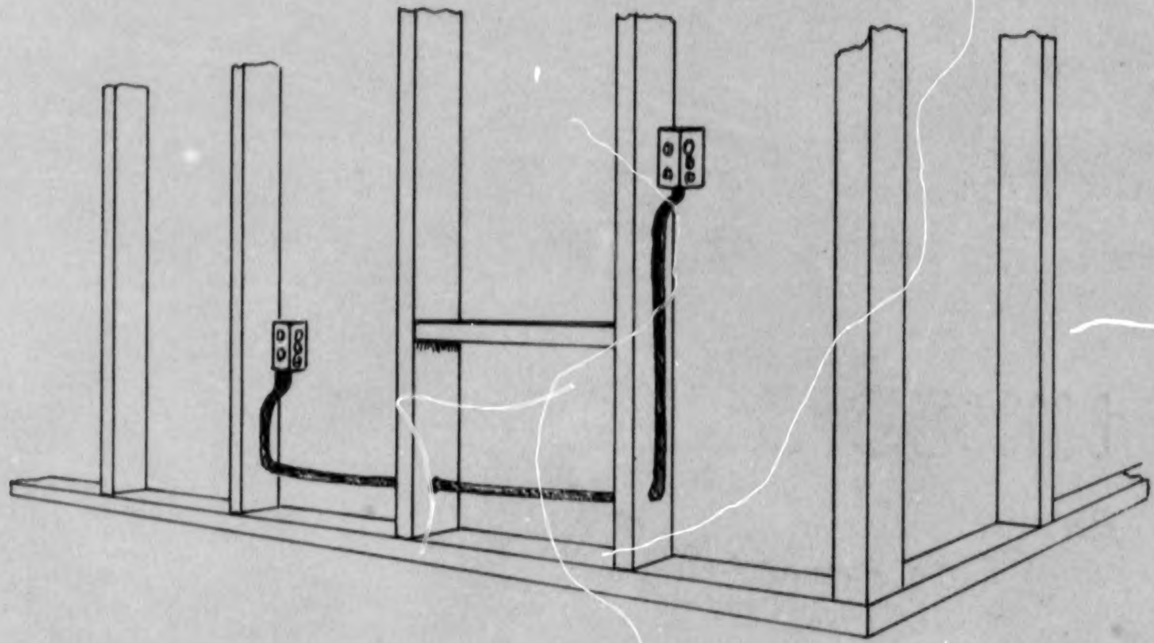
TURN THE PAGE AND BEGIN

Unit 10
Installing Cable in House Framing

Introduction

New houses have the electrical wiring installed after the framing has been put up. This is why it is important to know how to install electrical cable in house framing. This unit will show you how to install cable in house framing and tools you will need to do this.

The experience you gained in installing and wiring receptacles on a plywood base will help you in this lesson.



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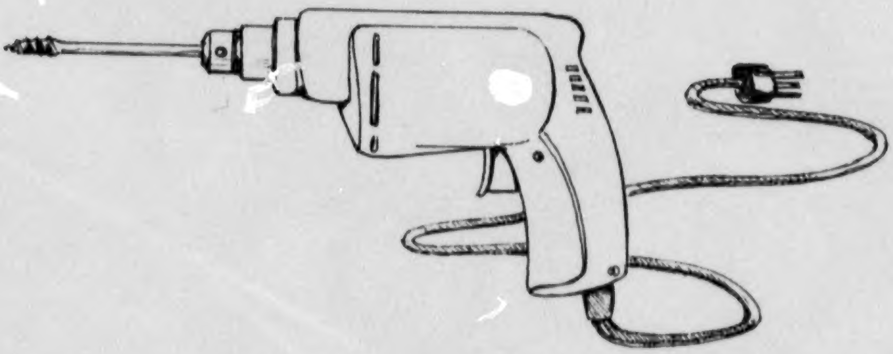
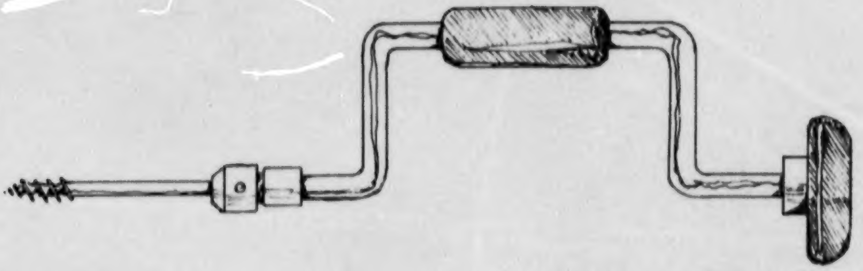
Unit 10
Installing Cable in House Framing

A. Tools, Materials and Equipment for Installing Cable in House Framing.

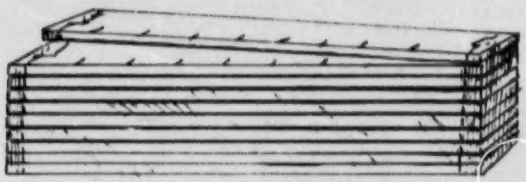
1. **POWER DRILL:** Used to drill holes in studs.



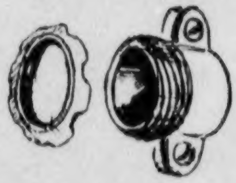
2. **HAND BRACE AND BIT:** Used manually to drill holes in studs for cable installation.



3. **FOLDING RULE:** Used to measure distances for drilling studs.



4. **BOX CONNECTOR:** Device used to secure cable to receptacle boxes.



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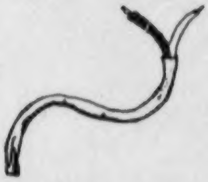
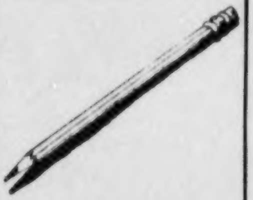
B. Steps for Installing Cable in House Framing.

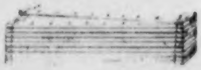
1. Find and Check Off the following.



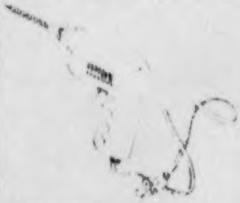
☐ NM Cable



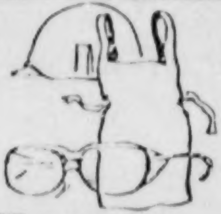
☐ Pencil



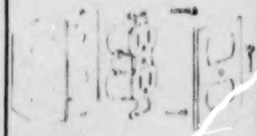
☐ Folding Rule



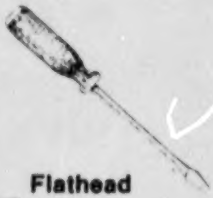
☐ Power Drill



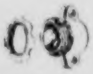
☐ Safety Equip



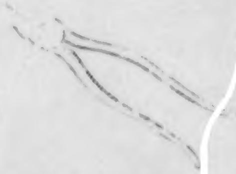
☐ Outlet Assembly



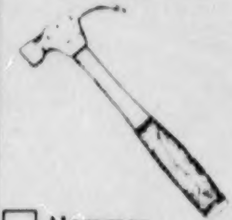
☐ Flathead Screwdriver



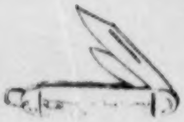
☐ Cable Connector



☐ Side Cutting Pliers

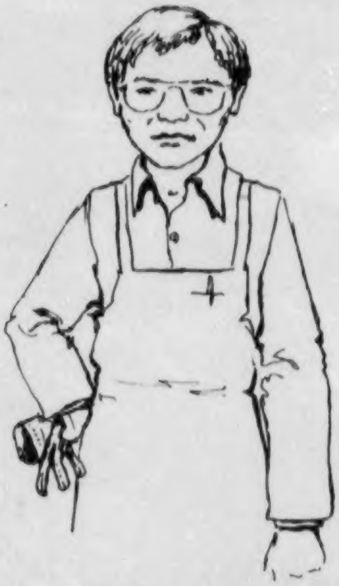


☐ Hammer

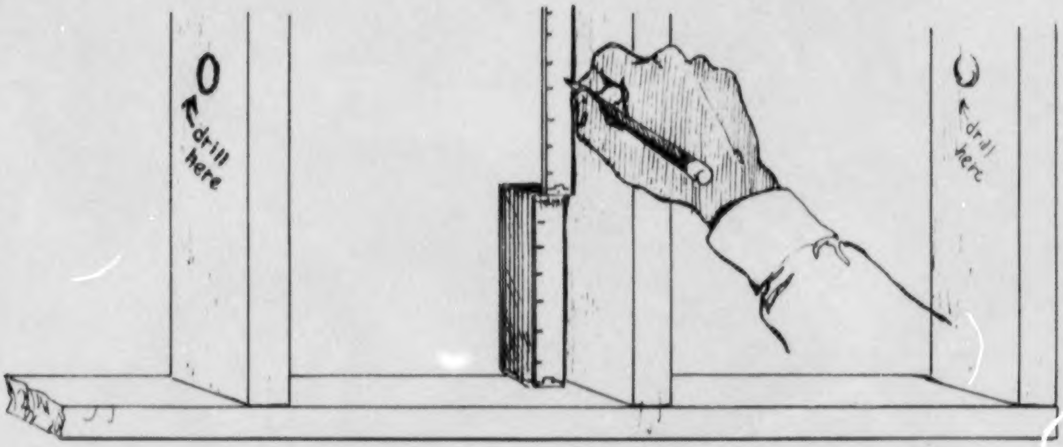


☐ Pocket Knife

2. Wear proper safety equipment.

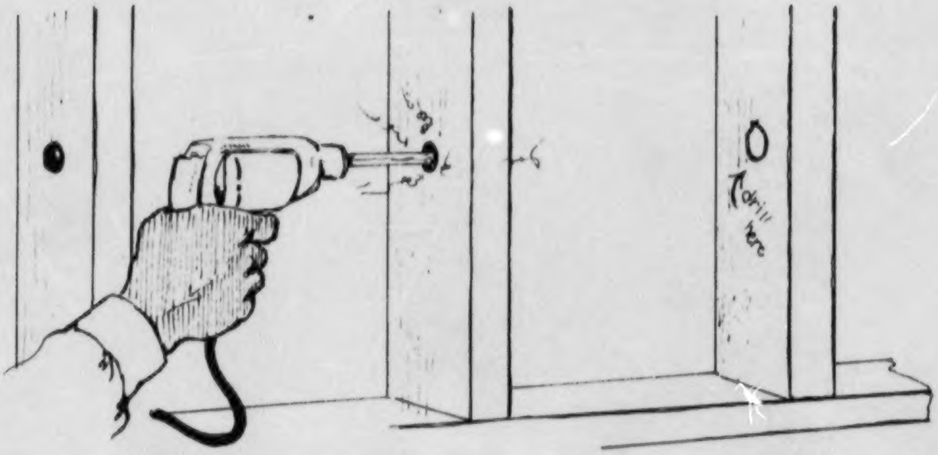


3. Measure and mark locations for the holes to be drilled.

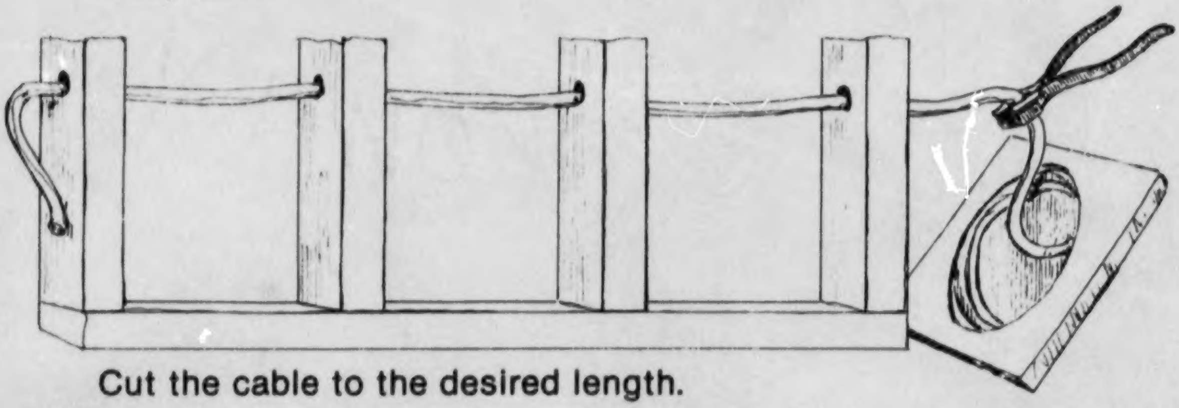

drill here
drill here

Make sure your markings are in the center of the stud.

4. Drill holes through the stud with the power drill or brace and bit.



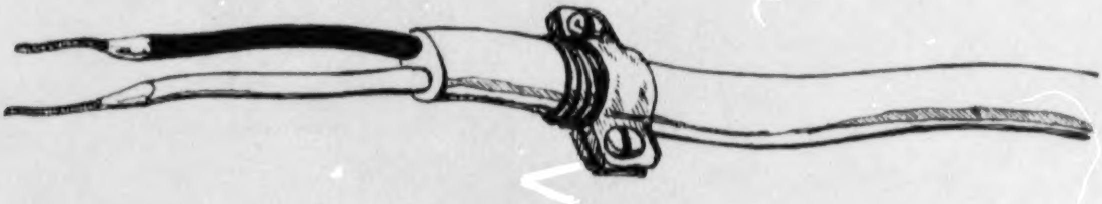
5. Run the cable through the drilled holes to the location of the receptacle.



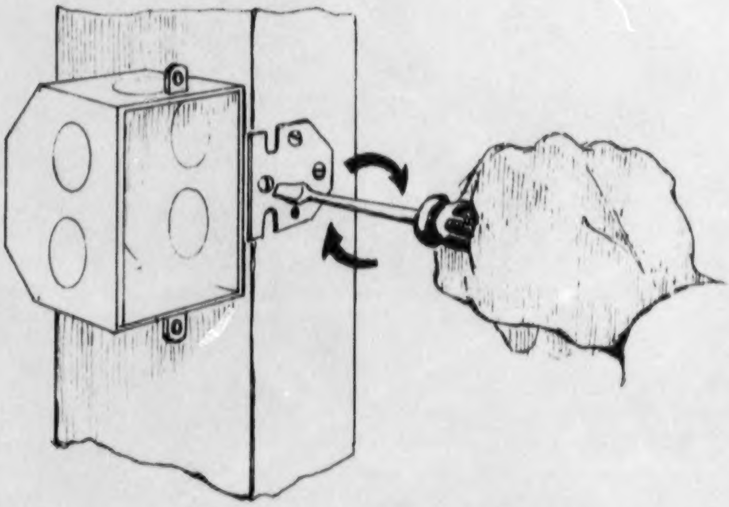
Cut the cable to the desired length.

6. Remove outer insulation from the cable.

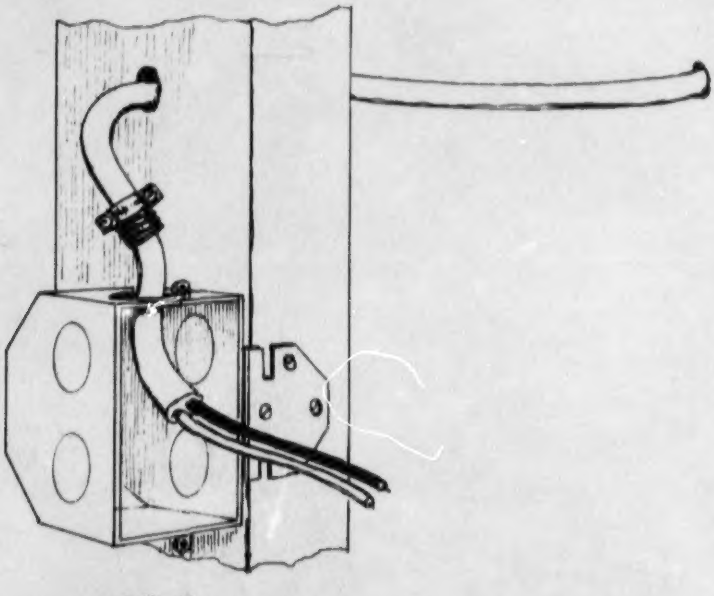
   Slip the cable connector on the cable.



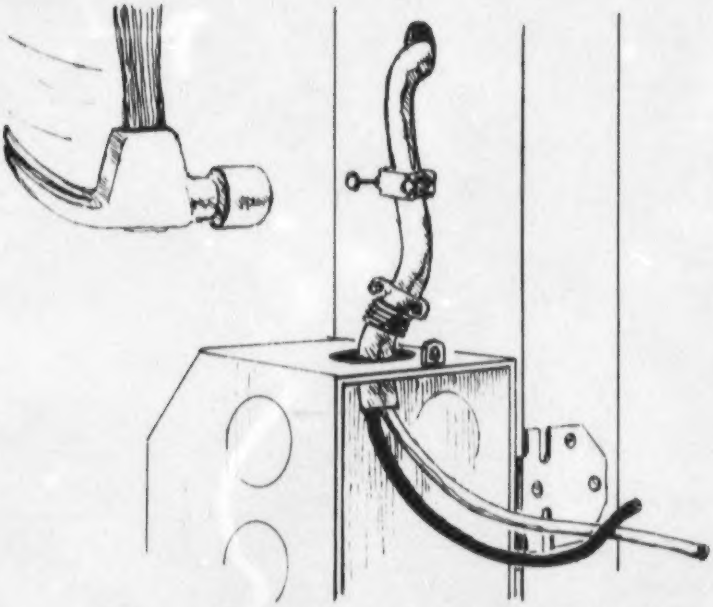
7. Attach the outlet box to the stud.



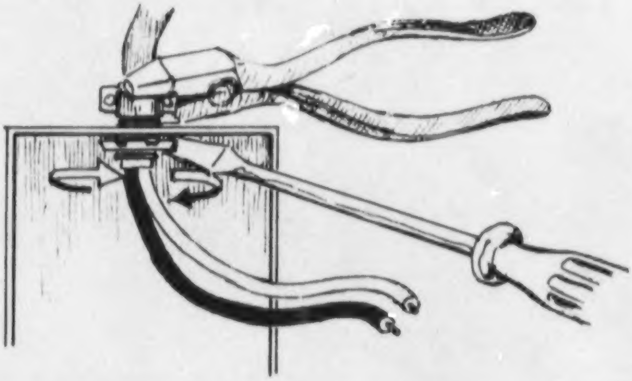
8. Insert the cable through the knockout hole. Pull about 6 inches of cable through the hole.



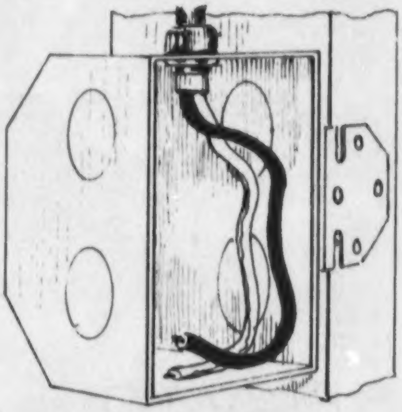
9. Attach the cable to the studs with cable straps.



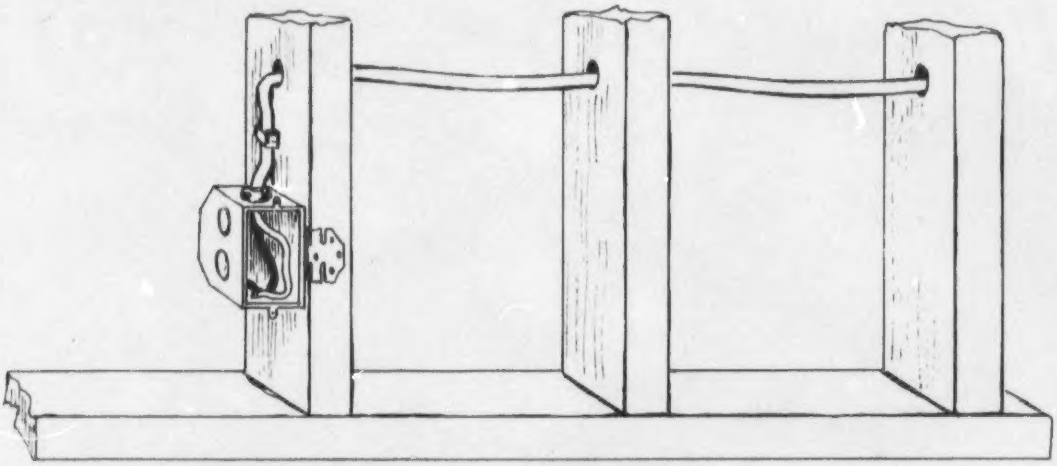
10. Using the screwdriver and side cutting pliers, fasten the locknut inside the box to the threaded end of the cable connector.



11. Fold the wires into the box. This will prevent the wire from being damaged.



12. Have your instructor check your wiring work.



13. Clean your work area and put tools in their proper places.

SEE YOUR INSTRUCTOR

Unit 10

Installing Cable in House Framing

Practical Exercise Performance Checklist

Student ______________________ successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Cable connector			
b. Power drill			
c. Brace and bit			
d. Folding rule			
e. Cable Strap			
2. Wore proper safety equipment.			
3. Measured and correctly marked hole locations on the studs.			
4. Drilled holes through marking on the studs.			
5. Ran cable through the holes to the outlet box location and cut cable to length.			
6. Removed insulation from the cable.			
7. Attached the outlet box correctly in its location.			
8. Installed cable through knockouts on the boxes allowing six inches of it to project out of the box.			
9. Attached cable to the studs.			
10. Correctly attached cable to the outlet box.			
11. Neatly folded cable into the box.			
12. Checked work with instructor.			
13. Cleaned up work area and returned tools to their proper places.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

______________________ Instructor's Signature

________ Date